SPECIFICATION NUMBER 116865G
CODE IDENT 57039
December 20, 1999

PRIME ITEM DEVELOPMENT SPECIFICATION

FOR THE

CLOSE COMBAT TACTICAL TRAINER

CONTRACT NO. N61339-93-C-0004
CDRL SEQUENCE NO. A01C

Prepared for:

Simulation, Training and Instrumentation Command
Project Manager Combined Arms Tactical Trainer
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CHANGE HISTORY

DATE	NUMBER	REV	REASON
06/07/93	116852	-	Initial Release of the basic sections of the PIDS
07/02/93	116853	-	Initial Release of Appendixes H, I
07/27/93	116852	A	Incorporate Customer Comments to the basic sections of the PIDS
	116853	A	Incorporate Customer Comments to Appendixes H, I
07/30/93	116854	-	Initial Release of Appendixes J, K, L
08/11/93	116853	B	Incorporate Customer Comments to Appendixes H, I
08/13/93	116855	-	Initial Release of Quality Assurance Provisions
10/21/93	116853	C	Incorporate Customer Comments to Appendixes H, I
	116854	A	Incorporate Customer Comments to Appendixes J, K, L
12/13/93	116865	-	Consolidation of all PIDS sections into a single document.
06/28/94	116865	A	Block Update to include BCRs and Clarification of Requirements.

CHANGE HISTORY-CONTINUED

DATE	REV	PAGES	DESCRIPTION
12/15/94	B		BCR No. 033B - Fire Detection System Requirement Clarificaiton.
		Page(s) 11	Paragraph 2.1
		44	3.6
		52	3.7.1
		106-108	3.8.4.26
12/15/94	B		BCR No. 038 - Correct HMMWV Eyepoint
		Page(s) A-25	Paragraph A.30.2.1.7
		A-39	A.30.3.3
		L-6	L.30.1.1.9
12/15/94	B		BCR No. 043A PIDS Table A-1 Update
		Page(s) 52-55,	Paragraph 3.7.1
		58-62	
		86	3.7.10
		153-155,	4.8
		161	
		A-5,8,9	A.30.2.1
		A-56-65	Table A-1

DATE	REV	PAGES	DESCRIPTION
12/15/94	B		BCR No. 061 Eliminate Land-lines from Baseline
		Page(s)23	Paragraph 3.1.3
		25	Figure 5
		56,59,	Paragraph 3.7.1
		64	3.7.2
		83-85	3.7.6
		92	3.7.10
		157	4.8.10
		G-20	30.1.2.3 (EIU, all Appendices)
		H-55	
		I-48	
		J-52	
		K-36	
		L-16	
12/15/94	B		BCR No. 068 - Modify use of ”USE” statement.
		Page(s)76	Paragraph 3.7.3.2.1
12/15/94	B		BCR No. 071 - 102 inch wide trailer.
		Page(s)97	Paragraph 3.8.4.6.4
12/15/94	B		BCR No. 072 ESIG2000 Cabinet Upgrade
		Page(s)97	Paragraph 3.8.4.6.4
12/15/94	B		BCR No. 079 - Mobile CCTT Storage Temperatures.
		Page(s)95	Paragraph 3.8.2.1
12/15/94	B		BCR No. 080 - Mobile CCTT Humidity vs Temperature Requirement.
		Page(s)6	Paragraph 2.1
		95-96	3.8.2.2

DATE	REV	PAGES	DESCRIPTION

DATE	**REV**	**PAGES**	**DESCRIPTION**
12/15/94	B	Page(s)105	BCR No. 081 - Mobile Start-up Time. Paragraph 3.8.4.23
12/15/94	B	Page(s)B-1 B-7	BCR No. 089 - Change FED-STD-406 to UL94. Paragraph B.20.1.1 B.30.2.6
12/15/94	B	Page(s)F-10	BCR No. 092 - SAF Vehicle Stochastic Failures. Paragraph F.30.1.2.2.5
12/15/94	B	Page(s)38	BCR No. 098 - Delete Visual Maintenance Monitor. Paragraph 3.2.9.4
12/15/94	B	Page(s)83 F-9	BCR No. 099 Deletion of Communications Jamming Paragraph 3.7.6 F.30.1.2.2.5

DATE	REV	PAGES	DESCRIPTION
12/15/94	B		Editorial changes to clarify requirements and resolve TBDs.
		Page(s) 27-28	Paragraph 3.2.1
		29	3.2.2
		31	3.2.7
		51	3.6.6
		51-62	3.7.1
		65-72	3.7.2
		75-80	3.7.3
		86-94	3.7.10
		118-191	Section 4
		A-6-53	Appendix A
		F-4-10	Appendix F
		G-1-20	Appendix G
		H-3-55	Appendix H
		I-3-47	Appendix I
		J-3-52	Appendix J
		K-4-36	Appendix K
		L-1-16	Appendix L
12/15/94	B		The following sections were deleted to remove training tasks from the Manned Modules:
		Page(s) 132-153	Section 4 Tables
		175-186	Paragraph 4.8
		G-1	G.30.1.1
		H-1	H.30.1.1
		I-1	I.30.1.1
		J-1	J.30.1.1
		K-1	K.30.1.1
		L-1	L.30.1.1
		51	3.6.8 Towing Fidelity (added)

DATE	**REV**	**PAGES**	**DESCRIPTION**
02/20/95	B		The following sections were modified to reflect the comments on contract letter dated 16 Feb 95.
		Page(s)50	Paragraph 3.6.5.7
		161	4.8.13.6.3, 4.8.13.6.4.1
		A-37	A.30.2.1.8.4
		B-1	B.20.1.1
		G-11	G.30.1.2.1.n.2
		H-4	H. Table H-I.
		H-12	H.30.1.2.1.a.4.b.iv
		H-25	H.30.1.2.2.1.a.6.a.i.1
		I-4,5	Table I-II.
		I-22	I.30.1.2.1.2.a.8.e.iii and iv
		I-23	I.30.1.2.1.2.a.8.e.v
		J-4	Table J-I
		J-5	Table J-I
		J-24	J.30.1.2.2.1.a.4.c
		J-25	J.30.1.2.2.1.a.6.b.i
		J-34	J.30.1.2.2.2.a.3.c
		J-39	J.30.1.2.2.3.a.4.c
		J-46	J.30.1.2.2.3.a.10.a.vi
		J-47	J.30.1.2.2.3.a.14.a
		L-3	L.30.1.1.7
		L-5	L.30.1.1.7.2
		L-10	L.30.1.2.1.2
		L-11	L.30.1.2.1.2.2 and L.30.1.2.1.2.2.1.1
		L-15	L.30.1.2.1.2.2.1.1.n, L.30.1.2.1.2.2.1.2, and L.30.1.2.1.2.2.1.2.1.e, f
		L-16	L.30.1.2.1.2.2.3
06/28/95	B		BCR No. 21A - SAF In-Scope Derived Visual Requirements
		Page(s)F-9	Paragraph F.30.1.2.2.5j
06/28/95	B		BCR No. 76A - Additional PIEs for the OC
		Page(s)52	Paragraph 3.7.1

DATE	**REV**	**PAGES**	**DESCRIPTION**
06/28/95	B	Page(s) A-33 G-6 G-10 H-17 H-55 I-13 I-26 J-13 J-51 K-11 L-9	BCR No. 087 - Sensor Device Specification Update. Paragraph A.30.2.1.7.5a G.30.1.2.1.a.4 G.30.1.2.1.l H.30.1.2.1.a.7 H.30.1.2.2.6.a.2.a I.30.1.2.1.1.a.16 I.30.1.2.1.2.a.22.a J.30.1.2.1.a.5 J.30.1.2.2.6.a.2.a K.30.1.2.1.l L.30.1.2.1.1.a.12
06/28/95	B	Page(s) A-48	BCR No. 88 - Map Generation Requirements Update Paragraph A.30.7.4.1.1
06/28/95	B	Page(s) A-16	BCR No. 101 - CWS Simplification Paragraph A.30.2.1.3.8
06/28/95	B	Page(s) A-22 H-55 I-26 J-51	BCR No. 102A - Binocular Implementations Paragraph A.30.2.1.6 H.30.1.2.2.6.a.1 I.30.1.2.1.2.a.21 J.30.1.2.2.6.a.1
06/28/95	B	Page(s) B-7	BCR No. 106 - Use of Alternate Plastic Materials Paragraph B.30.2.6.1
06/28/95	B	Page(s) 17 24	BCR No. 118 - SIMNET Gateway Paragraph Figure 1 Figure 4

DATE	**REV**	**PAGES**	**DESCRIPTION**
06/28/95	B	 Page(s)66	BCR No. 119 - AAR Headset Deletion Paragraph 3.7.2.2
06/28/95	B	 Page(s)43	BCR No. 120 - DI Compass Paragraph 3.6.d
06/28/95	B	 Page(s)G-5 H-8 I-8 J-8 K-5 L-6	BCR No. 121 - Revised Baseline for the Sound Generator Frequency Response Paragraph G.30.1.1.7.7 H.30.1.1.7.7 I.30.1.1.7.7 J.30.1.1.7.7 K.30.1.1.7.7 L.30.1.1.7.7
06/28/95	B	 Page(s)A-31 I-41 I-42	BCR No. 122 - Deletion of the M2A2/M3A2 Gunner's Head Tracker Paragraph A.30.2.1.7.2.e I.30.1.2.1.3.a.6 I.30.1.2.1.3.a.10
06/28/95	B	 Page(s)K-1 K-2 K-6 K-6 - K-12	BCR No. 131 - M113 Model for FIST-V Paragraph K.30.1 K.30.1.1.5 K.30.1.2 K.30.1.2.1

DATE	REV	PAGES	DESCRIPTION
06/28/95	B		BCR No. 132 - Module Sound Attenuation
		Page(s)38	Paragraph 3.2.10.2
		45	3.6n
		92	3.7.10.6
		G-3	Table G-I
		G-3	G.30.1.1.7
		H-5	Table H-II
		H-5	H.30.1.1.7
		I-5	Table I-III
		I-5	I.30.1.1.7
		J-5	Table J-II
		J-5	J.30.1.1.7
		K-3	Table K-I
		K-3	K.30.1.1.7
		L-3	Table L-I
		L-3	L.30.1.1.7
06/28/95	B		BCR No. 133 - Removal/Deferrment of SINCGARS Radio Features
		Page(s)G-17	Paragraph G.30.1.2.2.k
		H-47	H.30.1.2.2.3.a.9
		I-29	I.30.1.2.1.2.a.24
		J-43	J.30.1.2.2.3.a.9
		K-30	K.30.1.2.3.d
		L-14	L.30.1.2.1.2.2.1.1
06/28/95	B		BCR No. 137 - Revised Baseline for the Sound System Speakers
		Page(s)G-5	Paragraph G.30.1.1.7.7
		H-8	H.30.1.1.7.7
		I-9	I.30.1.1.7.7
		J-8	J.30.1.1.7.7
		K-5	K.30.1.1.7.7
		L-6	L.303.1.1.7.7

DATE	REV	PAGES	DESCRIPTION
06/28/95	B		BCR No. 141 - Change Printer Types
		Page(s)52	Paragraph 3.7.1
		66	3.7.2.1.4
		70	3.7.2.2.5
		74	3.7.3.1.4.c
		F-4	F.30.1.1.4.1
06/28/95	B		BCR No. 145 - Mobile MCOFT Power
		Page(s)111	Paragraph 3.8.5
06/28/95	B		BCR No. 150 - Delete RCU
		Page(s)55	Paragraph 3.7.1.2
		84	3.7.6.2.e
06/28/95	B		BCR No. 153 - Omni-Directional Sound for the Manned Modules
		Page(s)G-5	Paragraph G.30.1.1.7.4
		H-6	H.30.1.1.7.4
		I-8	I.30.1.1.7.4
		J-8	J.30.1.1.7.4
		K-5	K.30.1.1.7.4
06/28/95	B		BCR No. 159 - Upgrade DI module H/W
		Page(s)86	Paragraph 3.7.10.1.1
		87	3.7.10.2.1
		88	3.7.10.2.2
		91	3.7.10.2.4
		92	3.7.10.5
06/28/95	B		BCR No. 163 - Enhanced DI UCI
		Page(s)89	Paragraph 3.7.10.2.2
		90	3.7.10.2.4

DATE	REV	PAGES	DESCRIPTION
06/28/95	B		BCR No. 164 - Change TACP Visual/Movement Capabilities
		Page(s)61	Paragraph 3.7.1.6e
		61	3.7.1.6f
		62	3.7.1.6g
		62	3.7.1.6h
		62	3.7.1.6i
		85	3.7.6.3
06/28/95	B		BCR No. 166 - Simulated Rotation of the Night Vision Viewer
		Page(s)A-27	Paragraph A.30.2.1.7.1.e.2
		A-30	A.30.2.1.7.2.c.2
		H-17	H.30.1.2.1.a.7
		I-13	I.30.1.2.1.1.a.16
		J-13	J.30.1.2.1.a.5
06/28/95	B		PIDS Editorial
		Page(s)30	Paragraph 3.2.3
		51	3.6.8
		52	3.7.1
		59	3.7.1.4
		60	3.7.1.5
		75	3.7.3.1.5.c
		87	3.7.10.2.1
		A-6	A.30.2.1.1.2.3
09/15/95	C		BCR No. 8B - FED in DI/FIST-V
		Page(s)K-25	Paragraph K.30.1.2.3.c
09/15/95	C		BCR No. 157 - Crater Obstacles
		Page(s)56,57	Paragraph 3.7.1.2.2
		60	3.7.1.5
		63	3.7.1.6k
		A-5	A.30.2.1.1
09/15/95	C		BCR No. 160 - 5 Milli Ohm

DATE	**REV**	**PAGES**	**DESCRIPTION**
		Page(s)39 190 190	Paragraph 3.3.2.2 4.10 4.10.1
09/15/95	C		BCR No. 176 - M1A1 Block Fidelity Changes
		Page(s)H-18 H-18 H-18 H-19 H-19 H-19 H-26 H-27 H-30 H-32 H-33 H-34 H-34 H-34 H-35 H-37 H-37 H-37 H-41 H-41 H-41 H-45 H-51 H-53 H-54 H-54 H-54 H-54 H-54 H-54	Paragraph H.30.1.2.1.a.10 H.30.1.2.1.a.11 H.30.1.2.1.a.14c H.30.1.2.1.a.19 H.30.1.2.1.a.21 H.30.1.2.1.a.22 H.30.1.2.2.1.a.6.g H.30.1.2.2.1.a.10 H.30.1.2.2.1.a.19 H.30.1.2.2.2.a.1.f.iii H.30.1.2.2.2.a.2.b.viii H.30.1.2.2.2.a.2.c.vi H.30.1.2.2.2.a.2.c.vii.3 H.30.1.2.2.2.a.2.c.vii.4 H.30.1.2.2.2.a.2.d.i H.30.1.2.2.2.a.5.c H.30.1.2.2.2.a.5.d H.30.1.2.2.2.a.5.e H.30.1.2.2.2.a.9 H.30.1.2.2.2.a.13 H.30.1.2.2.2.a.15 H.30.1.2.2.3.a.8.i H.30.1.2.2.3.a.16 H.30.1.2.2.3.a.23 H.30.1.2.2.4.a.4 H.30.1.2.2.4.a.5 H.30.1.2.2.4.a.6 H.30.1.2.2.4.a.8 H.30.1.2.2.4.a.9 H.30.1.2.2.4.a.12
09/15/95	C		BCR No. 177 - M1A2 Block II Fidelity Changes
		Page(s)J-14	Paragraph J.30.1.2.1.a.8

DATE	REV	PAGES	DESCRIPTION
		J-14	J.30.1.2.1.a.9
		J-15	J.30.1.2.1.a.12.c
		J-15	J.30.1.2.1.a.17
		J-16	J.30.1.2.1.a.19
		J-16	J.30.1.2.1.a.20
		J-26	J.30.1.2.2.1.a.9
		J-28	J.30.1.2.2.1.a.16.g
		J-28	J.30.1.2.2.1.a.17
		J-32	J.30.1.2.2.2.a.2.d.i
		J-35	J.30.1.2.2.2.a.5.c
		J-35	J.30.1.2.2.2.a.5.d
		J-37	J.30.1.2.2.2.a.9
		J-37	J.30.1.2.2.2.a.13
		J-38	J.30.1.2.2.2.a.15
		J-40	J.30.1.2.2.3.a.7
		J-41	J.30.1.2.2.3.a.8.i
		J-48	J.30.1.2.2.3.a.16
		J-50	J.30.1.2.2.3.a.23

DATE	REV	PAGES	DESCRIPTION
09/15/95	C		BCR No. 178 - M2/M3 Block II Fidelity Changes

DATE	REV	PAGES	DESCRIPTION	
		Page(s)I-17	Paragraph	I.30.1.2.1.1.a.46
		I-18		I.30.1.2.1.1.a.52
		I-18		I.30.1.2.1.1.a.55
		I-18		I.30.1.2.1.1.a.56
		I-18		I.30.1.2.1.1.a.57
		I-18		I.30.1.2.1.1.a.58
		I-20		I.30.1.2.1.1.b.6
		I-26		I.30.1.2.1.2.a.19
		I-41		I.30.1.2.1.3.a.5.b
		I-41		I.30.1.2.1.3.a.9
		I-42		I.30.1.2.1.3.a.15
		I-42		I.30.1.2.1.3.a.16
		I-43		I.30.1.2.1.4.a.2
		I-43		I.30.1.2.1.4.a.5
		I-44		I.30.1.2.1.4.a.7
		I-44		I.30.1.2.1.5.a.1.a
		I-44		I.30.1.2.1.5.a.2.a
		I-44		I.30.1.2.1.5.a.2.b
		I-44		I.30.1.2.1.5.a.2.d
		I-44		I.30.1.2.1.5.a.2.e
		I-47		I.30.1.2.2
09/15/95	C		BCR No. 179 - HMMWV Block II Fidelity Changes	
		Page(s)L-9	Paragraph	L.30.1.2.1.1.a.17
		L-9		L.30.1.2.1.1.a.19
		L-10		L.30.1.2.1.1.a.21
		L-10		L.30.1.2.1.1.b
		L-15		L.30.1.2.1.2.2.1.2
		L-16		L.30.1.2.1.2.2.3

DATE	REV	PAGES	DESCRIPTION
09/15/95	C		BCR No. 183 - M981 Block II Fidelity

DATE	REV	PAGES	DESCRIPTION
			Changes
		Page(s)K-13	Paragraph K.30.1.2.1.t
		K-22	K.30.1.2.2.l.8
		K-23	K.30.1.2.2.p
		K-23	K.30.1.2.2.t
		K-23	K.30.1.2.2.t.1
		K-23	K.30.1.2.2.t.2
		K-23	K.30.1.2.2.t.3
		K-23	K.30.1.2.2.t.4
		K-31	K.30.1.2.3.j
		K-31	K.30.1.2.3.l
		K-32	K.30.1.2.4.e
09/15/95	C		BCR No. 184 - M113A3 Block II Fidelity Changes
		Page(s)G-13	Paragraph G.30.1.2.1.t
		G-19	G.30.1.2.2.m
09/15/95	C		BCR No. 186 - Small Arms Effects
		Page(s)A-11	Paragraph A.30.2.1.2.4.3.2
09/15/95	C		BCR No. 192 - PIDS Update for Communications
		Page(s)84	Paragraph 3.7.6.1
09/15/95	C		BCR No. 195 - DI Manned Modules Visuals IR Support
		Page(s)A-34, A-35	Paragraph A.30.2.1.7.7

DATE	REV	PAGES	DESCRIPTION

DATE	REV	PAGES		DESCRIPTION	
09/15/95	C			BCR No. 197 - Table A-Platform/Ammunition correlation and clarification	
		Pages	55	Paragraph	3.7.1
			60, 61		3.7.1.2.1
			62		3.7.1.5
			62		3.7.1.6j
			63		3.7.1.6j2
			A-56, A-64, A-66		3.7.1.6j6 Table A-1
			G-1		G.30.1.1.3
			G-1		G.30.1.1.3.1
			G-2		G.30.1.1.3.2
			H-2		H.30.1.1.3
			I-1		I.30.1
			I-2		I.30.1.1.3
			I-2		I.30.1.1.3.1
			I-2		I.30.1.1.3.2
			J-2		J.30.1.1.3
			K-1		K.30.1.1.3
			L-1, L-2		L.30.1.1.3

DATE	**REV**	**PAGES**	**DESCRIPTION**	
09/15/95	C		PIDS Editorial	
		Page(s)27	Paragraph	3.2.1.1
		27		3.2.1.l
		43		3.6d
		47		3.6.2a
		48		3.6.4i
		51		3.6.8
		64		3.7.2.1.1h
		66		3.7.2.2.1.1
		75		3.7.3.1.4c
		95		3.7.10.6.7
		96		3.8.1.d
		103		3.8.4.19.5.2.6
		104		3.8.4.20.3
		87		3.7.10.1.1
		93		3.7.10.6
		187		4.8.23.1.8
		93		Table III
		A-6		A.30.2.1.1.2.3
		A-6		A.30.2.1.1.2.5
		A-7		A.30.2.1.1.2.7
		A-7		A.30.2.1.2.1.1
		A-8		A.30.2.1.2.1.4
		A-9		A.30.2.1.2.3
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		A-13		A.30.2.1.2.5.3
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		J-28		J.30.1.2.2.2.a.1
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		J-29		J.30.1.2.2.2.a.1.f.i
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		J-34		J.30.1.2.2.2.a.4.a
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		L-8		L.30.1.2.1.1.a.6
		L-8		L.30.1.2.1.1.a.7
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		Page(s)G-20 G-20	Paragraph G.30.1.2.2.o G.30.1.2.2.o.1
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		Page(s)J-25 J-25	Paragraph J.30.1.2.2.1.a.6.b.i J.30.1.2.2.1.a.6.b.i.1
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		Page(s)J-25	Paragraph J.30.1.2.2.1.a.5.b
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		Page(s)K-8	Paragraph K.30.1.2.1.b.5.b
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		Page(s)I-24 I-24 I-24 I-24 I-24 I-24 I-24	Paragraph I.30.1.2.1.2.a.16 I.30.1.2.1.2.a.16.a I.30.1.2.1.2.a.16.b I.30.1.2.1.2.a.16.c I.30.1.2.1.2.a.16.d I.30.1.2.1.2.a.16.e I.30.1.2.1.2.a.16.f

01/18/96	D		PTR No. 3704
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		Page(s)K-9	Paragraph K.30.1.2.1.b.7
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		Page(s)K-24 K-24 K-24 K-24 K-24	Paragraph K.30.1.2.2.w K.30.1.2.2.w.1 K.30.1.2.2.w.2 K.30.1.2.2.w.3 K.30.1.2.2.w.4
01/18/96	D		PTR No. 3802
		Page(s)J-38	Paragraph J.30.1.2.2.3.a.3.g
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		Page(s)G-8 I-10	Paragraph G.30.1.2.1.b.5.b I.30.1.2.1.1.a.2.a
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		J-48	J.30.1.2.2.3.a.21.d
		J-48	J.30.1.2.2.3.a.21.e
		J-48	J.30.1.2.2.3.a.21.f
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01/18/96	D		PTR No. 3986
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		H-52	H.30.1.2.2.3.a.21.b
		H-52	H.30.1.2.2.3.a.21.c
		H-52	H.30.1.2.2.3.a.21.d
		H-52	H.30.1.2.2.3.a.21.e
		H-52	H.30.1.2.2.3.a.21.f
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01/18/96	D		PTR No. 4036
		Page(s)H-26	Paragraph H.30.1.2.2.1.a.6.e.i
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		A-21	A.30.2.1.5.2.5
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		H-23	H.30.1.2.2.1.a.3.a
		H-24	H.30.1.2.2.1.a.5.a
		H-28	H.30.1.2.2.1.a.17
		H-28	H.30.1.2.2.1.a.17.a
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		H-37	H.30.1.2.2.2.a.5.h
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		I-11	I.30.1.2.1.1.a.6
		I-11	I.30.1.2.1.1.a.7
		I-11	I.30.1.2.1.1.a.10
		I-11	I.30.1.2.1.1.a.11
		I-11	I.30.1.2.1.1.a.12
		I-13	I.30.1.2.1.1.a.16.a
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12/16/99	G		PTR No. 892 Paragraphs 2.2, 3.1, 3.1.3.1, 3.1.3.1.1, 3.2.1, 3.2.1.2, 4.8.13.7.4.1.3, 4.8.1.6, 4.8.33.1 Figure 1, 3 and 4 Appendix A Table A-L

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1.1 Identification.

This specification establishes the performance, design, development, and inspection requirements for the Close Combat Tactical Trainer (CCTT) prime item.

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2. Applicable documents.

Unless otherwise specified, the following specifications, standards, handbooks, and other Non-Government documents form a part of this specification to the extent specified herein, to the exact issue identified by the Document Summary List.

2.1 Government documents.

SPECIFICATIONS:

FEDERAL

W-L-305	-	Light Set, General Illumination (Emergency or Auxiliary).
ZZ-T-381	-	Tires, Pneumatic, Vehicular (Highway).
W-C-596	-	Connector Plug, Receptacle, and Cable Outlet Electrical Power, General Specification for.
QQ-B-654 Amend 1	-	Brazing Alloys, Silver.
ZZ-R-765	-	Rubber Silicone (General Specification).
UL 94	-	Standard for Tests for Flamability of Plastic Materials for Parts in Devices and Appliances.

MILITARY

MIL-T-27	-	Transformers and Inductors (Audio, Power, and Supp 1B High Power Pulse), General Specification for.
MIL-W-80	-	Window, Observation, Acrylic Base, Anti-electrostatic,Transparent (for Indicating Instrument).
MIL-G-174	-	Glass, Optical.
MIL-C-675 Amend 3	-	Coating of Glass Optical Elements (Anti-Reflection).
MIL-S-867 Notice 1	-	Steel Castings, Corrosion Resisting Austenitic.

MIL-R-3065 Amend 1	-	Rubber, Fabricated Parts.
MIL-C-3133 Notice 1	-	Cellular Elastomeric Materials, Fabricated Parts.
MIL-G-3787 Notice 1	-	Glass, Laminated, Flat (except Aircraft).
MIL-H-3912	-	Hardwood Components, Fabricated: For Military Vehicles.
MIL-P-5425	-	Plastic, Sheet, Acrylic, Heat Resistant.
MIL-R-6855 Supp 1	-	Rubber, Synthetic, Sheets, Strips, Molded or Extruded Shapes, General Specification for.
MIL-S-7124	-	Sealing Compound, Elastomeric, Accelerator Required, Aircraft Structure.
MIL-B-7883	-	Brazing of Steels, Copper, Copper Alloys, Nickel Alloys, Aluminum and Aluminum Alloys.
MIL-T-7928 Supp 1	-	Terminals, Lugs: Splices; Conductors: Crimp Style, Copper, General Specification for.
MIL-W-8939	-	Welding, Resistance, Electronic Circuit Modules.
MIL-S-11030 Notice 1	-	Sealing Compound, Noncuring, Polysulfide Base.
MIL-W-13518	-	Wood Preservative; Tetrachlorophenol and Pentachlorophenol, Surface Sealing Compound
MIL-O-13830 Amend 3	-	Optical Components for Fire Control Instruments; General Specification Governing the Manufacture, Assembly and Inspection of.
MIL-F-14072 Amend 1	-	Finishes for Ground Signal Equipment.
MIL-P-15024	-	Plates, Tags and Bands for Identification of

Supp 1A		Equipment.
MIL-W-18142	-	Wood Preservative Solutions, Oil-Soluble, Ship Amend 3 and Boat Use.
MIL-C-22750	-	Coating, Epoxy, VOC-Compliant.
MIL-P-23377	-	Primer Coatings: Epoxy, Chemical and Solvent Resistant.
MIL-G-25871 Amend 1	-	Glass, Laminated, Aircraft, Glazing.
MIL-F-29046	-	Flooring, Raised; General Specification for.
MIL-C-39006/22 Amend 1A	-	Capacitors Fixed, Electrolytic (Nonsolid Electrolyte),Tantalum, (Polarized, Sintered Slug), 85 ^{o}C (Voltage Derated to 125 ^{o}C) Established Reliability, Style CLR79.
MIL-C-39006/25	-	Capacitors Fixed, Electrolytic (Nonsolid Electrolyte), Tantalum, Established Reliability, Style CLR81.
MIL-S-45344	-	Semitrailer, Van; Commercial (Furniture, Personnel, Refrigerator, Cargo, and Side Curtain) 7 to 35 ton.
MIL-A-46106 Notice 1	-	Adhesive Sealants, Silicone RTV, General Purpose.
MIL-A-46146 Notice 1	-	Adhesive-sealant,, Silicone, RTV, Non-corrosive (For Use with Sensitive Metals and Equipment).
MIL-P-53030	-	Primer Coating, Epoxy, Water Reducible, Lead and Chromate Free.
MIL-P-55110 Amend 3	-	Printed Wiring Boards, General Specification for.
MIL-G-81704	-	Glass, Aircraft Instrument, Lighting Wedge and Cover.

MIL-A-83995	-	Packaging of Automated Data Processing Equipment (Major Components).
MIL-T-89301	-	1:50,000 Scale Topographic Maps of Foreign Areas.

STANDARDS:

FEDERAL

FIPS #1-1	-	Code for Information Interchange.
FIPS #50	-	Recorded Magnetic Tape for Information Interchange (6250 CPI, Group Coded).
FED-STD-66	-	Steel, Chemical Composition and Hardenability.
FED-STD-297	-	Rustproofing of Commercial (Nontactical) Vehicles.
FED-STD-595	-	Colors Used in Government Procurement.

MILITARY

MIL-STD-17	-	Mechanical symbols for aeronautical, aerospacecraft and spacecraft use.
MIL-STD-129	-	Marking for Shipment and Storage
MIL-STD-130	-	Identification marking of US military property.
MIL-STD-171	-	Finishing of Metals and Wood Surfaces.
MIL-STD-209	-	Slinging and Tiedown Provisions for Lifting and Tying Down Military Equipment.
MIL-STD-210C	-	Climatic Information to Determine Design and Test Requirements for Military Systems and Equipment.
MIL-STD-252	-	Classification of Visual and Mechanical Defects for Equipment, Electronic, Wired, and other

devices.

MIL-STD-275 Notice 1	-	Printed Wiring for Electronic Equipment.
MIL-STD-454	-	Standard General Requirements for Electronic Equipment.
MIL-STD-461	-	Electromagnetic Emission and Susceptibility Requirements for the Control of Electromagnetic Interference.
MIL-STD-462	-	Electromagnetic Interference Characteristics, Measurement of.
MIL-STD-471	-	Maintainability Verification/Demonstration/Evaluation.
MIL-STD-721	-	Definition of Terms for Reliability and Maintainability.
MIL-STD-781	-	Reliability Testing for Engineering Development, Qualification, and Protection.
MIL-STD-810	-	Environmental Test Methods and Engineering Guidelines.
MIL-STD-882	-	System Safety Program Requirements.
MIL-STD-889 Notice 2	-	Dissimilar Metals.
MIL-STD-1130 Notice 2	-	Connections, Electrical, Solderless Wrapped.
MIL-STD-1223	-	Administrative Wheeled Vehicles Treatment, Painting,Rustproofing, Undercoating, Identification Marking, Data Plates, and Warranty Notice Standards.
MIL-STD-1472	-	Human Engineering Design Criteria for Military Systems, Equipment, and Facilities.

MIL-STD-1474	-	Noise Limits for Army Material.
MIL-STD-1686	-	Electrostatic Discharge Control Program for Protection of Electrical and Electronic Parts, Assemblies,and Equipment.
MIL-STD-1815	-	American National Standards Institute(ANSI)/MIL Reference Manual for the Ada Programming Language.
MIL-STD-2000	-	Standard Requirements for Soldered Electrical and Electronic Assemblies.
MS75021	-	Connector, Receptacle, Electrical--12 Contact Intervehicular, 28 Volt (V), Waterproof.
DOD-STD-2167	-	Defense System Software Development.
DOD-STD-5200.28	-	Security Requirements for Automated Information Systems

OTHER GOVERNMENT AGENCY

HANDBOOKS:

MILITARY

MIL-HDBK-781 - Reliability Test Methods, Plans, and Environments for Engineering Development, Qualification and Production.

DEPARTMENT OF DEFENSE

DOD-HDBK-263	-	Electrostatic Discharge Control Handbook for Protection of Electrical and Electronic Parts, Assemblies and Equipment (Excluding Electrically Initiated Explosive Devices).

SIMULATION, TRAINING AND INSTRUMENTATION COMMAND (STRICOM)

881052B	-	System Specification for Close Combat Tactical Trainer Device 17-159
PMT91-W024	-	Statement of Work for Close Combat Tactical Trainer Device 17-159

OTHER PUBLICATIONS:

ARMY

AR 40-10	-	Health Hazard Assessment Program on Support of the Army Materiel Acquisition Decision Process
FM 17-12-1-2-3	-	Tank Gunnery
FM 101-5-1	-	Operational Terms and Symbols

CLASSIC SOVIET TACTICS (OPFOR):

FM 100-2-1	-	The Soviet Army Operations and Tactics
FM 100-2-3	-	The Soviet Army Troops, Organization and Equipment

US TACTICS AND DOCTRINE (BLUFOR):

FM 71-1	-	Tank and Mechanized Infantry Company Team
FM 71-2	-	The Tank and Mechanized Infantry Battalion Task Force
FM 17-15	-	Tank Platoon
FM 17-57	-	Scout Platoon
FM 17-97	-	Regimental Armored Cavalry Troop
FM 17-95	-	Cavalry Operations
FM 7-91	-	Tactical Employment of Anti-Armor Platoons, Companies, and Battalions
FM 7-7J	-	The Mechanized Infantry Platoon and Squad
FM 101-10-1	-	Staff Officer Field Manual
FM 7-9	-	Tactical Employment of Mortars

NAVAL AIR SYSTEM COMMAND (NAVAIRSYSCOM)

NAVTRASYSCEN (Naval Training	-	Simulator Sickness

Systems Center)
Field Manual Mod 3

AS-4613	-	General Specification for Application and Derating Requirements for Electronic Components.
NAVTRASYSCEN Technical Report: TR86-002	-	CAI Evaluation Checklist: Human Factors Guidelines for the Design of Computer-Aided Instruction.

DEPARTMENT OF LABOR

Code of Federal Regulations, Title 29	-	Occupational Safety and Health Standards

DEPARTMENT OF TRANSPORTATION (DOT)

Federal Motor Carrier Safety Regulations.
Federal Motor Vehicle Safety Standards and Regulations.

DEFENSE MAPPING AGENCY

PS/3AG/201	-	Product Specifications for Topographic Maps: 1:100,000 Scale
PS/1AE/201	-	Product Specifications for Joint Operations Graphics Series 1501 and Series 1501 Air: Scale 1:250,000

(Copies of specifications, standards, drawings, and publications required by suppliers in connection with specific procurement functions shall be obtained from the procuring activity or as directed by the Procuring Contracting Officer (PCO).)

2.2 Non-Government documents.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI/IEEE 446	-	IEEE Recommended Practices for Emergency and Standbys Power Systems for Industrial and Commercial Applications.
ANSI X3T9/85-39	-	FDDI Physical Layer Protocol (PHY)
ANSI X3T9/88-139	-	FDDI Media Access Control (MAC-M)
ANSI X3T9/90-	-	FDDI Station Management (SMT)

ANSI Z535.3-1991 - Criteria for Safety Symbols

ANSI Z535.4-1991 - Product Safety Signs and Labels

(Applications for copies should be addressed to the Tire and Rim Association, Inc., 3200 West Market Street, Akron, OH 44313.)

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C1036 - Standard Specification for Flat Glass.

(Application for copies should be addressed to the American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103-1137.)

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE 200 - Reference Designations for Electrical and Electronic Parts and Equipment.

IEEE 802.2 - IEEE Standards for Local Area Networks: Logical Link Control

IEEE 1278-1993 - Standard for Information Technology - Protocols for Distributed Interactive Simulation Applications.

(Application for copies should be addressed to the Institute of Electrical and Electronics Engineers, 445 Hoes Lane, Piscataway, NJ 08854-4150.)

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA-Code 101 - Code for Safety of Life from Fire in Buildings and Structures.

NFPA-70 - National Electric Code.

NFPA-72 - Standard for Installation, Maintenance and use of Protective Signalling Systems.

NFPA-75 - Electronic Computer/Data Processing Equipment.

(Requests for copies should be addressed to National Fire Protection Association, 60 Batterymarch Street, Boston, MA 02110.)

SOCIETY OF AUTOMOTIVE ENGINEERS, INC. (SAE)

SAE J318 - Air Brake Gladhand Service (Control) and Emergency (Supply) Line Couplers—Trucks, Truck-Tractors, and Trailers.

SAE J534	-	Lubrication Fittings, Standard.
SAE J560	-	Seven-Conductor Electrical Connector for Truck-Trailer Jumper Cable, Standard.
SAE J682	-	Rear Wheel Splash and Stone Throw Protection, Recommended Practice.
SAE J700	-	Upper Coupler Kingpin—Commercial Trailers and Semitrailers; Standard.
SAE J702	-	Brake and Electrical Connection Locations--Truck-Tractor and Truck-Trailer, Recommended Practice.
SAE J1292	-	Automobile, Truck, Truck-Tractor, Trailer, and Motor Coach Wiring, Recommended Practice.

(Applications for copies should be addressed to the Society of Automotive Engineers, Inc., 400 Commonwealth Drive, Warrendale, PA 15096.)

TIRE AND RIM ASSOCIATION, INC. (TRA)

TRA Yearbook.

(Applications for copies should be addressed to the Tire and Rim Association, Inc., 3200 West Market Street, Akron, OH 44313.)

INSTITUTE FOR SIMULATION AND TRAINING

IST-CR-93-46 March 1994	Enumeration and Bit Encoded Values for Use with IEEE 1278.1-1994, Distributed Interactive Simulation - Application Protocols
IST-CR-93-35	Proposed IEEE Standard Final Draft - Exercise Control and Feedback Requirements for Distributed Interactive Simulation
IST-CR-94-15	Draft Standard for Distributed Interactive Simulation Communication Architecture and Security

(Applications for copies should be addressed to the University of Central Florida, Center for Continuing Education, Orlando, Florida, 32016-0177.)

PROJECT 2851-SIF

Draft Military Standard Simulator Database (SSDB) Interchange Format (SIF) for High Detail Input/Output (SIF/HDI) and Distributed Processing (SIF/DP)

(Applications for copies should be addressed to Wright Patterson Air Force Base ARC/YP-C, Dayton, Ohio, 45433.)

MAGNAVOX ELECTRONICS SYSTEMS COMPANY

MX-25-212D - Window Log for Advanced Field Artillery Tactical Data System (AFATDS) Operational Software, Version 1, 21 May 1993, Volumes 3,4,6

(Applications for copies should be addressed to the RCI, 3051 Technology Prkwy, Suite 290, Orlando, Florida, 32826.)

(Non-Government standards and other publications are normally available from the organizations that prepare or distribute the documents. These documents also may be available in or through libraries or other informational services.)

ROCKWELL INTERNATIONAL CORPORATION

523-0778175-001M17 Precision Lightweight GPS Receiver PLGR+96 & PLGR+96 FEDERAL Precise Positioning Service (PPS) Operations and Maintenance Manual

(Applications for copies should be made to Collins Avionics & Communications Division, Rockwell International Corporation, Cedar Rapids, Iowa, 52498)

2.3 Order of precedence.

In the event of a conflict between the text of this specification and the references cited herein, the specification takes first precedence.

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3. System requirements.

3.1 Training System Definition.

The CCTT is a simulation system wherein various simulated elements replicating actual combat vehicles, weapon systems, and command and control elements are networked for real-time, fully interactive collective task training on computer generated terrain.

The CCTT system shall use a Local Area Network (LAN) to provide this collective training and a Long Haul Network (LHN) to provide extended operations when required. (The extended operations requiring the linking of several CCTT systems is a Pre-Planned Product Improvement (P3I) requirement). The CCTT System shall provide training to individual crew and unit personnel as identified in section 3.5, covering the skills and knowledge of crew through company task force level doctrine for the implementation of combat missions. The tactical areas, and prototype vehicles simulated by CCTT shall be:

a. Operations Center (OC)

b. Administrative Logistic Center (ALOC)

c. Tactical Operations Center (TOC)

d. Unit Maintenance Collection Point (UMCP)

e. Fire Direction Center (FDC)

f. Field Artillery Battalion Tactical Operation Center (FABTOC)

g. Tactical Air Control Party (TACP)

h. Higher Headquarters Support

i. Communications

j. Semi-Automated Forces (SAF)

k. M1A1 / M1A2 vehicles

l. M2A2 / M3A2 vehicles

m. Dismounted Infantry (DI)

n. M981 Fire Support Team Vehicle (FIST-V)

o. M113A3 Armored Personnel Carrier (APC)

p. High Mobility Multipurpose Wheeled Vehicle (HMMWV)

The basic fixed site CCTT system configuration shall be composed of manned modules, consoles/workstations, and network system identified below as items a thru l.

a. OperationsCenter

b. Master Control Console

c. After Action Review Console

d. Maintenance Console

e. SAF

f. NetworkSystem

g. M1A1, M1A2 modules

h. M2A2/M3A2 modules

i. DI module

j. M981 FIST-V module

k. M113A3 APC module

l. HMMWV module

The basic fixed site CCTT system configuration shall be capable of being expanded to satisfy the various training needs by the addition of manned module items g thru l. The Mobile CCTT configurations shall be composed of items a through f, and the M1A1 tank, M2A2/M3A2 Bradley Fighting Vehicle (BFV) and DI manned modules. The Quickstart CCTT configurations shall be composed of a Master Control Console, a network system, M1A1 tank, and M2A2/M3A2 Bradley Fighting Vehicle manned modules. Items a through e shall collectively be referred to as the CCTT system Consoles / Workstations. Items g through l shall collectively be referred to as the CCTT system manned modules.

3.1.1 CCTT training system diagrams.

Figure 1, Close Combat Tactical Trainer System Diagram - Fixed Site, shows the interconnection of the manned modules, and consoles/workstations for a fixed site system configuration.
Figure 2, Close Combat Tactical Trainer System Diagram - Mobile Site, shows the interconnection of the manned modules and consoles/workstations for a mobile site system configuration.
Figure 3, Close Combat Tactical Trainer System Diagram - Quickstart, shows the interconnection of the manned modules and the Master Control Console for a Quickstart system configuration.

3.1.2 Training tasks.

The CCTT system will provide visual, aural, tactile, and dynamic cuing to allow the users to perform the collective tasks for the simulated weapons systems and units.

Figure 1 Close Combat Tactical Trainer System Diagram - Fixed Sites

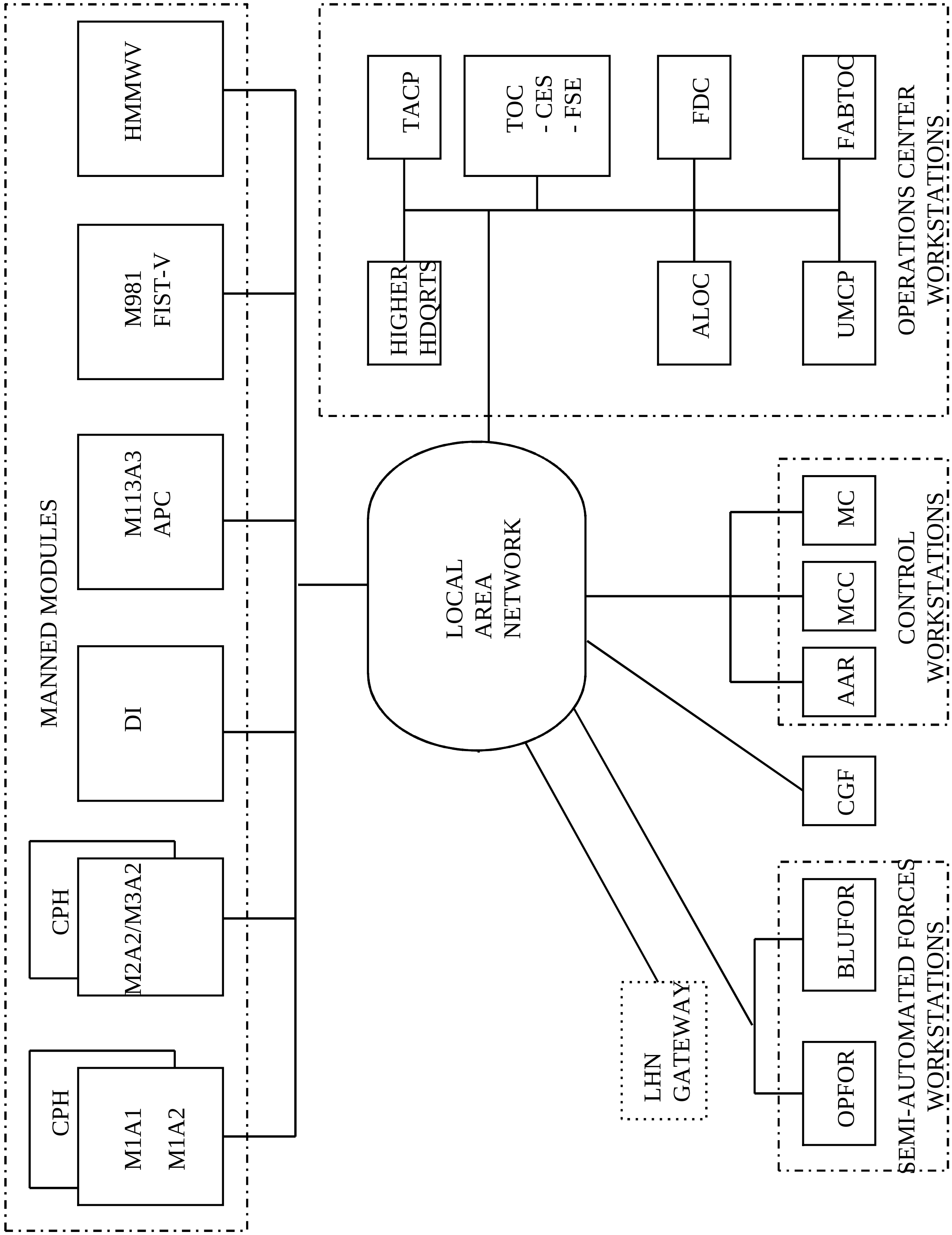


Figure 2   Close Combat Tactical Trainer System Diagram - Mobile Sites

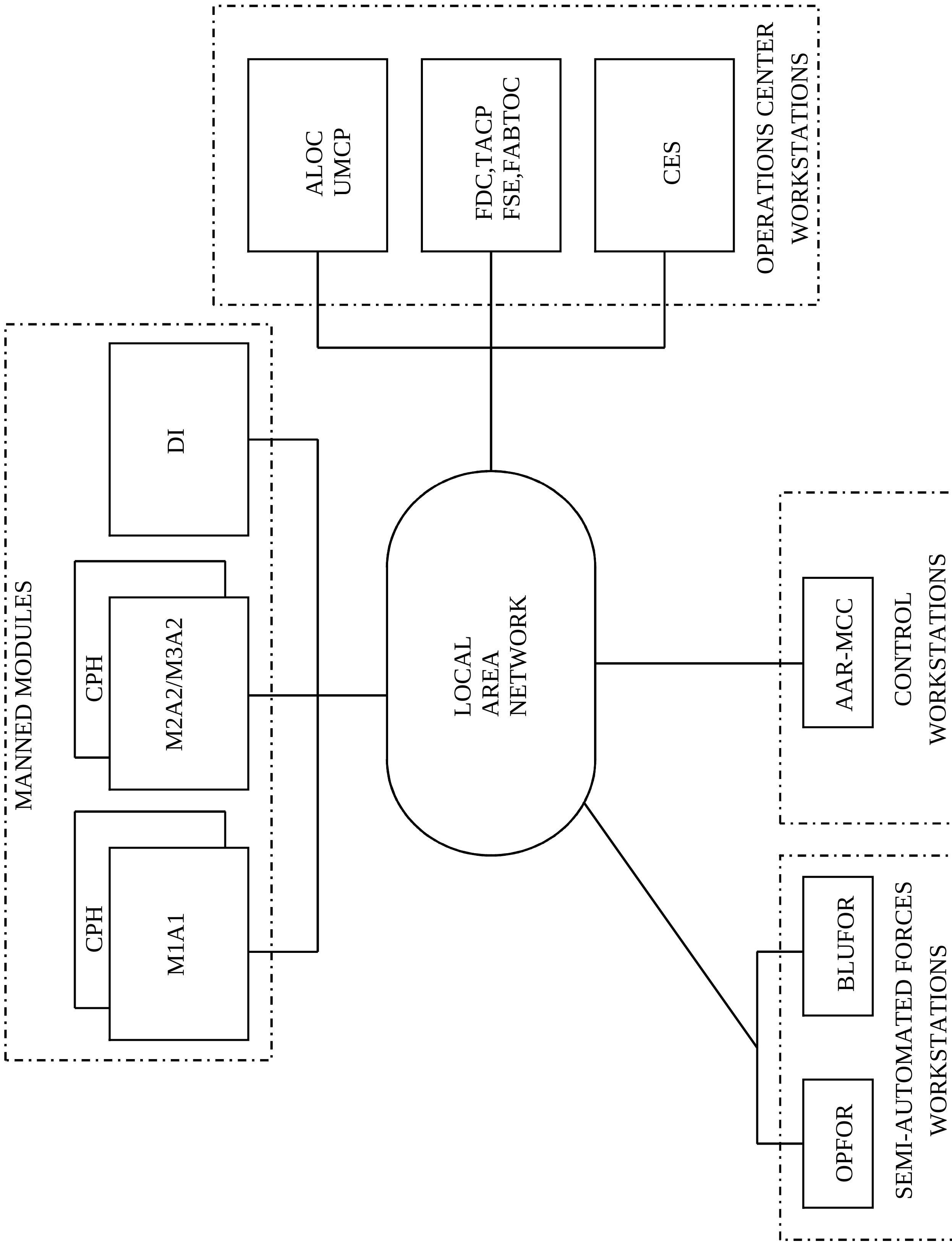
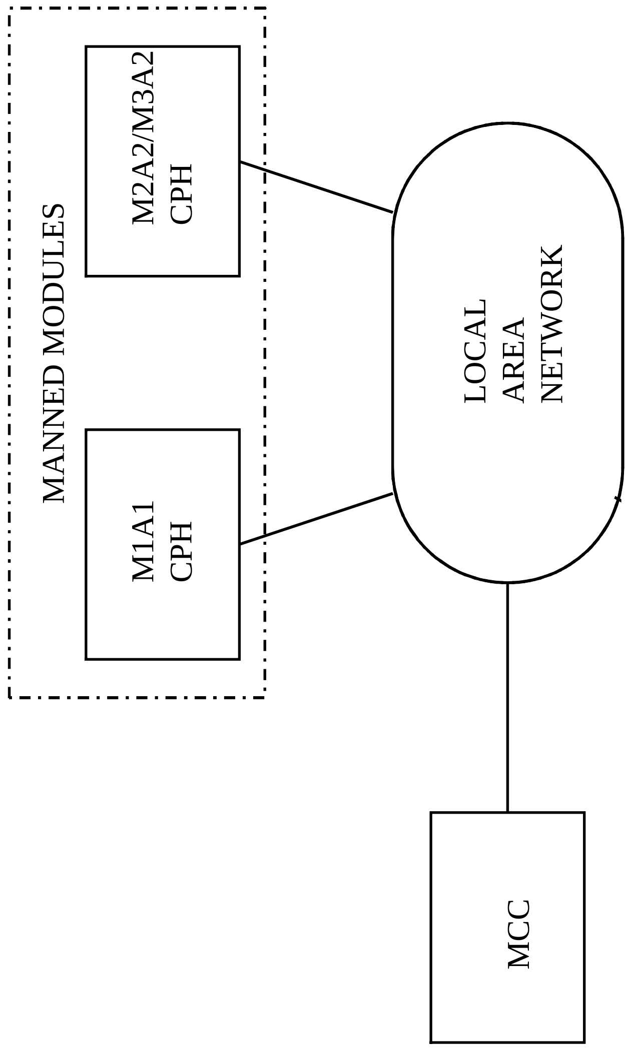


Figure 3 Close Combat Tactical Trainer System Diagram - Quickstart Sites



3.1.3 Interface Definition.

Figure 4 shows the external interfaces supported by the CCTT system and the internal interfaces between major components of the system. These interfaces are summarized in the following paragraphs. Requirements for some of the interfaces are defined in other paragraphs of this specification, in those cases the interface is briefly described and the applicable requirements paragraph is referenced. The statement of those requirements which are contained elsewhere in the specification are not duplicated in these paragraphs.

3.1.3.1 External System Interfaces.

The CCTT system delivery of exercise initialization data, long term off-line storage of exercise data, creation of an exercise ”take home” video tape, and entry of terrain databases into the system. These interfaces are described in the following paragraphs.

The CCTT system power interface will conform to the requirements of paragraph 3.2.7.5 for both the fixed site and Quickstart configurations and to the requirements of paragraph 3.8.5 for the mobile configuration**.**

3.1.3.1.2 Exercise Initialization.

The CCTT system will provide an interface to accept magnetic media (ie. floppy disk) to support initialization of an exercise. The magnetic media will be able to be generated away from the training site and then provided to the MCC operator for loading into the system. The requirements for this interface are defined in paragraph 3.7.2.1.1.

3.1.3.1.3 Exercise Off-Line Storage.

The CCTT system will provide an interface to support long term off-line storage of exercises in magnetic media.. The interface will provide for the storage of all exercise data captured by the AAR as defined in paragraph 3.7.2.2.4.

3.1.3.1.4 Video Interface.

The CCTT system will provide a VCR recorder to allow the AAR operator to create a ”take home” video tape of the exercise. The video provided to the VCR will be from the large screen display; that display is described in paragraph 3.7.2.2. Any display that can be presented on the large screen display will be capable of being recorded when it is being presented on the large screen display.

3.1.3.1.5 Terrain Database Interface.

The CCTT system shall provide an external interface with the Trainer System Support Environment (TSSE) for input and output of SIF compatible terrain databases.

3.1.3.1.6 System Facility Interface.

The CCTT system will interface to the facilities in which it will be installed in accordance with the System Facility Report.

3.1.3.2 Internal System Interfaces.

The principal internal interfaces within the CCTT system are 1) the interfaces between the major system components (manned modules and consoles/workstations) and 2) the interfaces within the major system components. Figure 4 shows the interfaces between major system components and Figure 5 show the interfaces within a major system component.

3.1.3.2.1 Interfaces between components.

The primary internal interface between major CCTT system components will be provided via the FDDI Local Area Network (LAN). The LAN requirements are as defined in paragraph 3.7.4. The LAN will transmit the exercise specific Protocol Data Units (PDUs) as defined in IEEE 1278-1993, and will be used to support updates of terrain databases and manned module and console/workstation system software.

3.1.3.2.1.1 TSSE to MC (MCC).

An interface shall be provided between the Trainer System Support Environment and the Maintenance Console (MC) to support down loading of new software versions and terrain databases. The interface shall be through the use of magnetic media.

The MC will then down load the data from the magnetic media to the rest of the system components through the LAN, as defined in paragraph 3.7.2.3.

A redundant interface of this same type shall be provided between the TSSE and MCC.

3.1.3.2.1.2 MCC LAN interfaces.

The MCC will use the simulation management Protocol Data Units (PDUs) of IEEE 1278-1993 to communicate with all of the consoles/workstations and manned modules in the CCTT system. The simulation management PDUs will be used to initialize, control, and monitor the set of exercises being conducted in the CCTT system. The consoles/workstations and manned modules will use the same set of IEEE 1278-1993 PDUs to respond to the MCC with status and data. The MCC will use file transfer protocols to execute the download of updated CCTT system software and/or terrain databases to the consoles/workstations and manned modules.

3.1.3.2.1.3 MC LAN interfaces.

The MC will use the simulation management PDUs to monitor and control the CCTT system BIT. The MC will receive the results of the BIT from the consoles/workstations and modules and will control the operation of the BIT within the system components. The MC will use file transfer protocols to execute the download of updated CCTT system software and/or terrain databases to the consoles/workstations and manned modules.

3.1.3.2.1.4 AAR LAN interfaces.

The AAR will receive all PDUs from the LAN for the exercise to which it is assigned. The AAR will record the PDUs as the exercise is being conducted. The AAR will be able to use the information from the stored PDUs to perform exercise playback, monitoring of the exercises in real-time, and perform the data collection and reduction described in paragraph 3.7.2.2.6.

3.1.3.2.1.5 SAF LAN interfaces.

The SAF consoles/workstations will transmit and receive PDUs per IEEE 1278-1993 to communicate SAF emulated entity data and actions and to accept data and action information from the other emulated and simulated entities in the same exercise. The SAF will support the simulation management PDUs required to respond to PDUs from the MCC and MC for exercise control and monitoring.

3.1.3.2.1.6 OC LAN interfaces.

The OC consoles/workstations will use the IEEE 1278-1993 PDUs to permit the OC operators and the associated emulated entities to participate in the exercises. This will include the entity state, weapons fire, and collision PDUs to support the entities emulated by the OC; the logistics PDUs to support resupply and repair from the OC; and the radio PDUs to support communications between the OC and the other system components which support communications. The OC will support the simulation management PDUs required to respond to PDUs from the MCC and MC for exercise control and monitoring. The OC will receive the full set of PDUs from the other consoles/workstations and manned modules participating in the same exercise.

3.1.3.2.1.7 Manned Modules LAN interfaces.

A manned module will send PDUs per IEEE 1278-1993 to all other workstations/consoles and manned modules participating in an exercise. This will include entity state, weapons fire, collision, logistics, emitter, and radio PDUs to allow the manned module crew to interact with the other entities in the exercise. The manned modules will support the simulation management PDUs required to respond to PDUs from the MCC and MC for exercise control and monitoring. The manned module will be capable of receiving and reacting to all PDUs from consoles/workstations and other manned modules participating in the same exercise.

3.1.3.2.2 Interfaces within components.

Figure 5 shows the internal interfaces between host processor and the components that comprise a workstation/console or manned module. Not all components may be supported in any single workstation/console or manned module. The following paragraphs describe the functions provided by the interfaces between these components.

3.1.3.2.2.1 Network interface.

The host processor will interface with the network to receive and send PDUs as described in the preceding paragraphs. The host processor will be responsible for processing the received PDUs and the creation of PDUs to be sent as a function of received PDUs and inputs from the other components within the manned module or workstation/console.

3.1.3.2.2.2 Visual system interface.

The host processor will provide the visual system with entity data which the visual system will process to create the console/workstation or manned modules view of the virtual battlefield on the image displays. The data provided to the visual system from the host processor will include information about the components view point, moving model selection parameters, selection and activation of animated sequences, visibility controls, and appearance and location information of entities within that field of view. The visual system will also interface to the host processor to provide status information to support BIT.

The visual system will interface to the image displays for output of the rendered images.

3.1.3.2.2.3 Communication system interface.

The communication system will receive analog voice signals from the radio, and intercom equipment and convert that data to digital voice message packets. The digital voice message packets will be sent from the communication system to the host processor. The host processor will route the message packets to the appropriate receiving radios by sending radio PDUs to the network. The communications system will provide status information to the host processor to support BIT.

The communication system will be able to receive digital voice message packets from the host processor and convert them to analog voice signals. The analog voice signals will be sent to the appropriate radios, and/or intercoms being supported by that communication system.

3.1.3.2.2.4 Controls and indicators interface.

An interface will be provided between the host processor and the controls and indicators system of a manned module. The controls and indicators system will sample the state of the operator controls of a manned module and then provide that state information to the host processor when requested. The host processor will analyze the controls and generate any required PDUs on the network or updates to the other component systems. The controls and indicators system will provide status information to the host processor to support BIT.

The controls and indicators system will be able to send indicator and control state updates to the controls and indicators in the manned module. The host processor will send updates to the state of the controls and indicators and the controls and indicators system will process those updates to turn indicator lamps on or off, change the reading of gauges, modify the reaction of operator controls, etc.

3.1.3.2.2.5 Sound system interface.

The sound system will receive commands and data from the host processor in order to generate sound cues and effects. The sound system will interface with speakers contained within the manned module or workstation/console. The sound system will send status information back to the host processor in order to support BIT.

3.1.3.2.2.6 Host processor interfaces.

In addition to the interfaces with the other component systems, the host processor will interface with a set of computer peripherals, controls, and displays. The peripheral interfaces will include interfaces to disk drives, tape drive, and printers as described in paragraph 3.7.3.1.4. The controls and displays interfaces will support operator control of the host processor for BIT, performance of workstation/console functions, and performance of virtual manned module tasks.

3.1.3.2.2.7 Power control interface.

The host processor will interface to the power control system to support application, control, and monitoring of power to the host and component systems. Power will be received from the power control system for the host processor and the other component systems.

Figure 4 CCTT System Interface Block Diagram

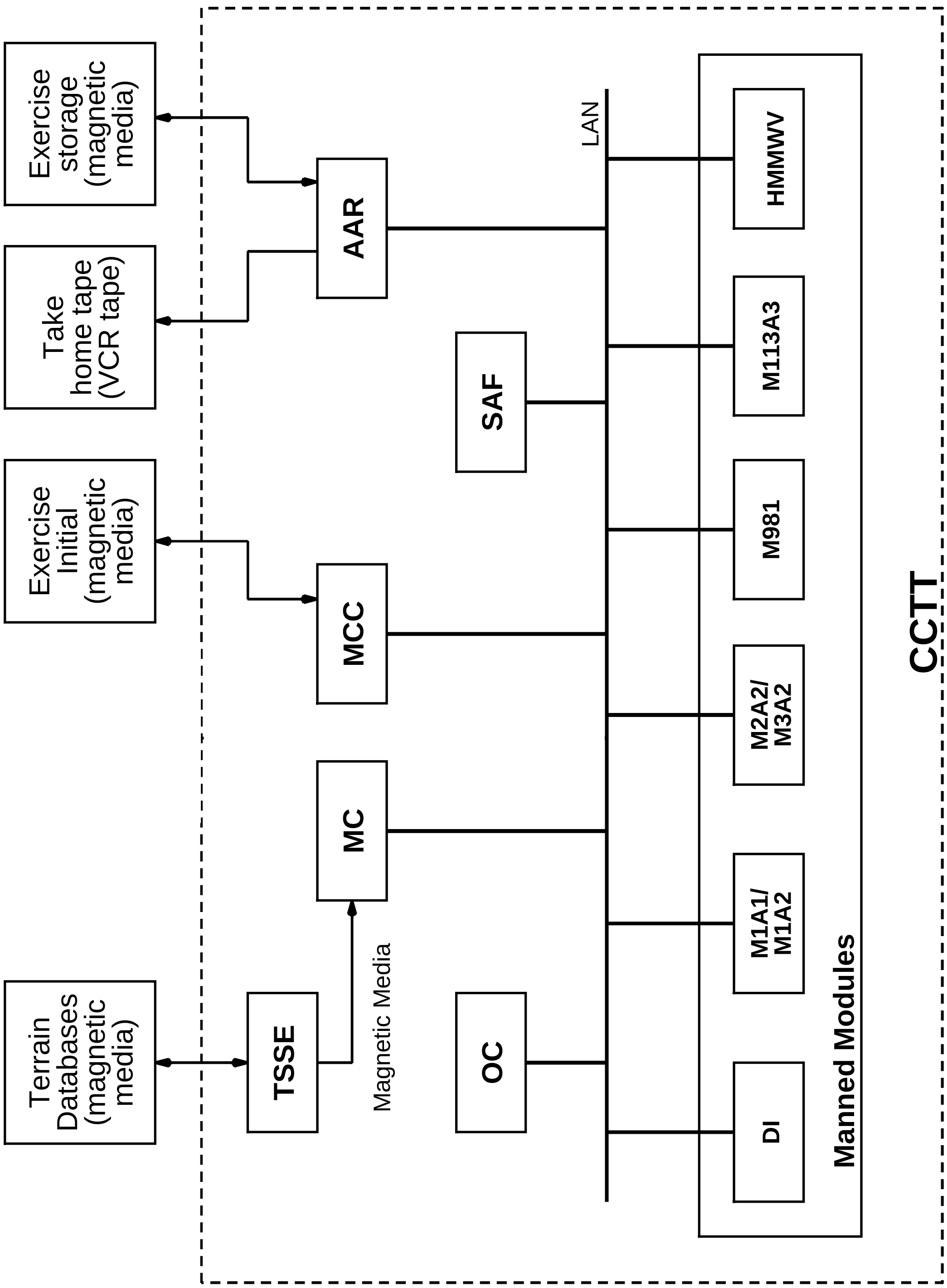
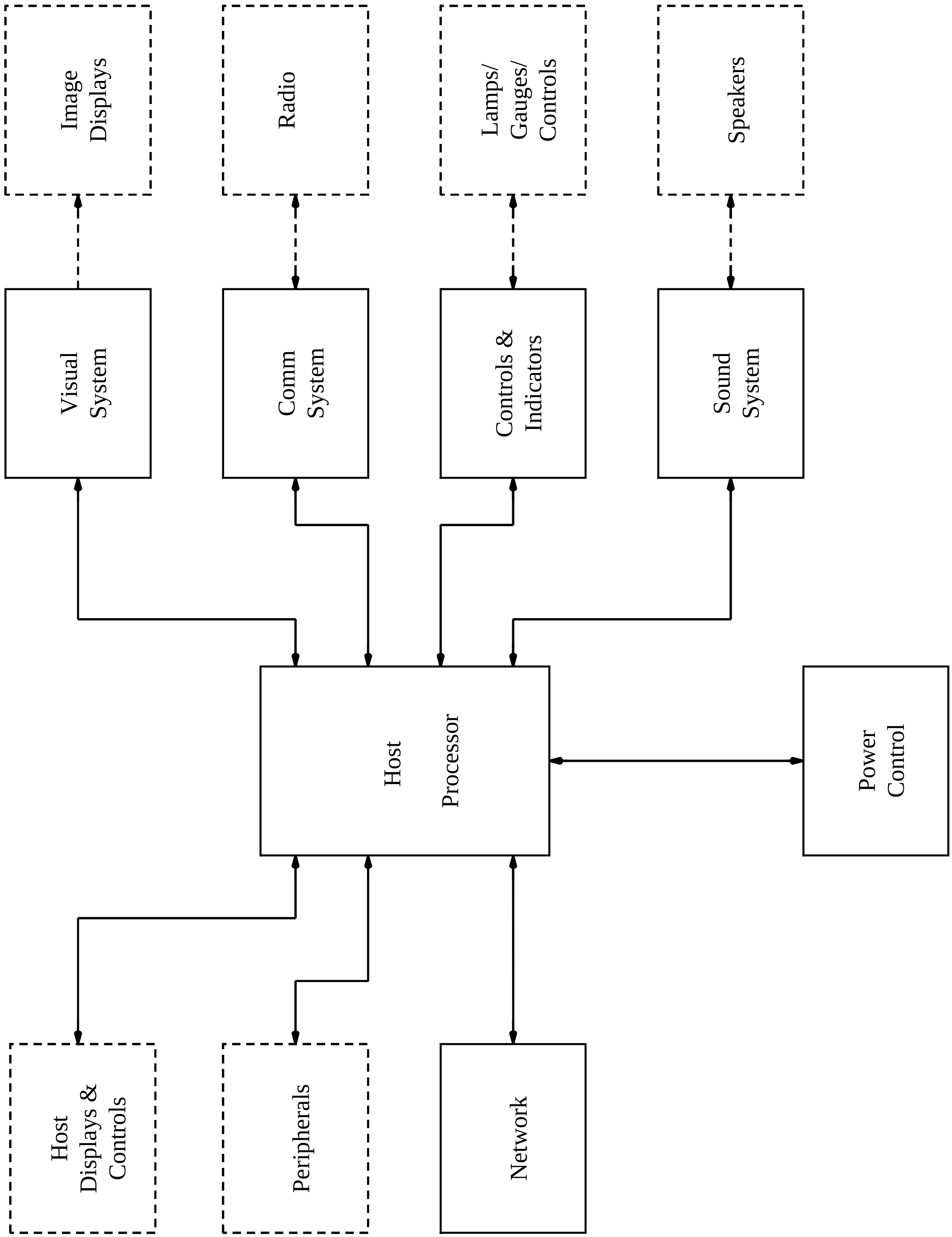


Figure 5   CCTT Major Component Generic Internal Interfaces



3.2 CCTT System design requirements.

The CCTT system shall use a parameter-driven, open, object oriented design architecture in the implementation of the CCTT manned modules, consoles / workstation, and network system components of the CCTT system. Each manned module shall be designed to operate autonomously and shall be able to transmit and receive changes in the state of entity variables or when events occur. The CCTT system shall be comprised of the manned modules, consoles / workstation and network system identified in section 3.1 and specified in the paragraphs and subparagraphs of section 3.7 and the appendices of this specification

3.2.1 CCTT system performance.

The CCTT system modules, consoles / workstations, and network shall implement techniques from the following areas to meet the CCTT system performance and design requirements. The areas are:

a. CCTT System Latency (transport delays).

b. Dead Reckoning Algorithms (DRAs).

c. Network Performance.

d. Design Modularity.

e. SAF Interactions.

The implementations of the above techniques shall be transparent in their operation to the individuals and groups training on the CCTT system.

The manned simulators and the consoles / workstation which comprise the CCTT system shall be reconfigurable from the Master Control Console to provide individual vehicle, platoon, and company sized exercises. Once an exercise configuration is established, the terrain correlation, system latencies, SAF interactions and overall fidelity shall be such that negative training, cartoonish effects, and unrealistic situations are minimized.

A fixed site CCTT system shall have the capability to provide from one up to and including five completely separate and independent exercises concurrently in any legal CCTT configuration subject to the maximum entity count identified in Section 3.7.4.1. The worst case mix for the five exercises shall be three company and two platoon level exercises simultaneously. The Mobile version of CCTT shall be required to support one exercise at a time when operating in a stand alone mobile configuration. The vehicle simulation modules within a CCTT mobile configuration shall support from one up to and including five exercises when a Mobile module(s) is connected to a CCTT fixed site system. An exercise shall operate on one terrain database at a time. The control of all of the selected exercises shall be supported by one Operation Center. The CCTT system shall provide the capability to perform data collection and after action review on one up to and including five exercises concurrently subject to the assignment of one exercise per each data collection - after action review console. The CCTT system shall provide the capability to perform CCTT communications on one up to and including five exercises concurrently subject to a maximum total of 60 communications channels. The CCTT system shall provide the capability to record 48 sets of total system checkpoint (reset) data. The 48 sets of checkpoint data shall represent the most recent sets of checkpoint data at any point in an exercise. The data logged shall include data sufficient to recreate the simulated operational, supply, damaged and failed state of simulated and emulated vehicles, the sequence of CIS executions and environmental situational data.

3.2.1.1 Interoperability.

a. Deleted

b. Not used.

c. Not used.

d. Not used.

e. Not used.

f. Not used.

g. Not used.

h. Not used.

i. Not used.

j. Not used.

k. Not used.

l. Not used.

m. Deleted

3.2.1.3 CCTT system standards.

The CCTT system design shall be based on the following emerging DoD, commercial, and international standards:

a. Distributed Interactive Simulation (DIS) Standard (I.E.E.E. 1278-1993 Standard for Information Technology - Protocols for Distributed Interactive Simulation Applications).

b. Modular Simulator System (MSS) Program (MODSIM) as defined in 3.2.5.

c. P2851 Standard Simulator Data Base Description. (The use of this standard shall be focused on incorporating file structures defined for SSDB and SIF (Standard Interface Format as defined in A.30.7.3).)

d. Final Draft Proposed IEEE Standard - Communication Architecture for Distributed Interactive Simulation (CADIS).

e. Final Draft Proposed IEEE Standard - Exercise Control and Feedback Requirements for Distributed Interactive Simulation.

These standards shall be in addition to the other standards and references specifically required in other areas of this Specification.

3.2.2 Latency.

3.2.2.1 System Latency.

System response for all observable visual and aural cues and interactions shall exhibit an average latency of between -150 milliseconds and +339 +/- 11 milliseconds from the time of input. The latency shall be measured as the average time from student input in one CCTT module (e.g., turning the steering control or firing the weapon) to presentation of the cue in another CCTT module. The system response for all observable events generated for emulated vehicles (SAF, OC, and emulated DI), measured as the average time from CGF event generation to presentation of the cue in a CCTT module, shall meet system latency requirements. LAN performance and system transmission rates shall be kept within parameters necessary to meet the system latency requirements. Processor simulation time clocks between two processors shall be synchronized to within +/- 20 milliseconds from the slowest clock time to the fastest clock time to support the correlation of PDUs which are a part of the protocol defined by IEEE-1278-1993.

3.2.2.2 Manned Module Latency.

Manned module latency - The average latency within a module shall not exceed 253 milliseconds (ms) +/- 20 ms.

3.2.3 Dead Reckoning Algorithms (DRAs).

DRAs shall be employed to maintain entity position and orientation in the database between receipt of actual entity position and orientation data. When a DRA is performed on a visual model the resulting visual update shall not exceed the time latencies for individual modules (253 +/- 20 ms). Every CCTT manned module, console and workstation shall utilize DRA methodology which shall avoid anomalous entity movement. Dead reckoning shall be defined as the practice of estimating the position and orientation of an entity and its articulated parts based on previous model data. The DRAs employed by CCTT shall employ a smoothing algorithm to correct entity direction and orientation once a network update identifies a change. The use of dynamic DRAs, characterized as the use of a lower level DRA than specified in the incoming Entity State PDU, shall be allowed in the set of mechanisms used in the management of the CPU processing capacity.

3.2.4 Not used.

3.2.5 Design modularity.

The CCTT system shall provide design commonality within and between objects connected on the LAN through the use of a modular design. System design modularity shall provide the capability to modify or replace primary functional elements within each object as an independent, self contained combination of hardware and software.

3.2.5.1 Model designs.

Mathematical models used to represent interactions internal to individual objects shall be defined and organized to meet modularity, latency and spare processing requirements.

3.2.6 Not used.

3.2.7 Physical characteristics.

The CCTT basic designs shall have the following physical characteristics as outlined in this specification. The system design shall be modular to allow for future product upgrades, modifications and preplanned product improvements (P3I). Paragraph 3.9 identifies possible P3I changes to the CCTT.

3.2.7.1 Weight.

The weight of the CCTT equipment shall not exceed a uniformly distributed maximum load of 100 pounds per square foot or a concentrated load of 1000 pounds applied on one square inch.

3.2.7.2 Ceiling height.

CCTT shall be capable of operation within a ceiling height of twelve feet.

3.2.7.3 Equipment access.

CCTT manned modules shall be capable of passage through a 120 inches wide by 120 inches high opening at the simulator bay and all other equipment shall be capable of passage through a 72 inch wide by 84 inch high opening for all other areas. The maximum size footprint of each manned module, including electronic cabinets, shall be 225 square feet (except Dismounted Infantry module which shall not exceed 500 square feet) and shall not exceed a height of 10 feet , 8 inches. These dimensional constraints shall allow for normal maintenance.

3.2.7.4 Trainer maintenance access.

The facility layout of a CCTT fixed site shall allow a minimum of one meter clearance from adjacent equipment or walls for passageways, maintenance, air circulation, and free movement of equipment except for surfaces requiring no maintenance access.

3.2.7.5 Electrical requirements.

Each CCTT system shall be designed to operate on standard 480V +/-10 percent, three phase, 60 Hz incoming site power except for those CCTT components to be delivered to locations utilizing 50 Hz power. Those shall be designed to utilize 380V +/-10 percent, three phase, 50 Hz incoming site power. The equipment shall be designed to tolerate the stated input power frequency +/-1 percent. The contractor shall provide and install power line conditioner(s) to protect the equipment from power fluctuations, sags, surges and transients from both source and equipment power sides.

3.2.7.5.1 Electrical design.

The equipment shall be designed to meet the requirements of the NFPA-70.

3.2.7.5.2 Emergency disconnect.

The equipment design shall include the emergency power disconnect(s) required by Section 645 of NFPA-70 with additional disconnects at the Master Control and Maintenance consoles.

3.2.7.5.3 Phase balance.

The equipment power distribution shall be designed so that the normal load on any one phase does not vary from the average load of the three phases by more than 7.5 percent.

3.2.7.5.4 Not used.

3.2.7.5.5 Utility power.

Utility electrical power receptacles shall be provided as part of the equipment installation. The receptacles shall be placed so that a W-C-596 approved duplex receptacle will be within 6 feet of any area where maintenance is to be performed.

3.2.7.6 Equipment cooling.

The temperature inside a manned module shall not exceed 80 degrees Fahrenheit when operated at full capacity with full personnel loading given a maximum ambient environment of 75 degrees Fahrenheit.

3.2.7.7 Console lighting.

Illumination shall be provided at the consoles to illuminate all panels, recorders, instruments, controls, and work surfaces in accordance with the recommended value for task and work areas given in Table XXI, MIL-STD-1472. The lighting shall not produce glare.

3.2.7.8 Grounding.

The Government will provide a building/facility earth ground connection point at fixed sites with a maximum resistance to earth of 10 ohms. The contractor shall be responsible for connecting to the building ground point.

3.2.7.8.1 Equipment grounding.

All CCTT manned modules and consoles/workstations requiring grounding shall utilize the facilities ground in the electronics equipment area.

3.2.7.9 Colors.

The CCTT exterior color for modules, trailers, and hardware components shall be determined during the contractor/Government design reviews. The interior colors shall match that of the simulated operational vehicles and command posts. All colors shall meet the requirements of FED-STD-595.

3.2.7.10 Cabling.

Facility power, CCTT major component interconnecting cables, and grounding cables shall be installed in facility provided overhead cabletrays. Cabling within any CCTT major component shall be placed such that the cabling does not present a trip hazard to operating personnel.

3.2.8 Reliability.

Reliability shall be in accordance with the following requirements.

3.2.8.1 Reliability quantitative requirements.

Specified MTBF values for each CCTT manned module, console, workstation and network equipment shall be as shown below:

MTBF (hours)	
M1A1 Simulator	540
M1A1 CPH Simulator	447
M1A2 Simulator	382
M1A2 CPH Simulator	364
M2A2/M3A2 Simulator	414
M2A2/M3A2 CPH Simulator	383

FIST-V Simulator	481
APC Simulator	497
HMMWV Simulator	870
DI Simulator	922
Operations Center	943
Operations Trailer	535
SAF	1504
AAR Work Station	796
Master Control Console	2232
Maintenance Console	1724
TSSE	926
Network Equipment Fixed Site	3096
Network Equipment Mobile Site	2083
Network Equipment Quickstart	2611

3.2.8.2 Derating criteria.

All trainer-unique equipment shall be subject to the Class A derating criteria of AS-4613. The semiconductor junction temperatures for electronic devices under worst-case circuit and environmental conditions shall be derated to 110 degrees Centigrade (^{o}C).

3.2.9 Maintainability.

Maintainability shall be in accordance with the following requirements and shall be applicable to the total CCTT hardware, unless otherwise specified. Specified MTTR values for each CCTT manned module, console, workstation, and network system shall be as shown below:

MTTR (Hours)

M1A1 Simulator	.95
M1A1 CPH Simulator	.95
M1A2 Simulator	1.00
M1A2 CPH Simulator	1.00
M2A2/M3A2 Simulator	.95
M2A2/M3A2 CPH Simulator	1.00
FIST-V Simulator	.95
APC Simulator	1.00
HMMWV Simulator	1.00
DI Simulator	.95
Operations Center	.95
Operations Trailer	.90
SAF	.95
AAR Work Station	1.00
Master Control Console	.95

Maintenance Console	.90
TSSE	1.00
Network Equipment Fixed Site	.90
Network Equipment Mobile Site	.90
Network Equipment Quickstart	.90

3.2.9.1 Maintainability quantitative requirements.

Quantitative maintainability requirements for CCTT shall be a MTTR of 66 minutes and a maximum-repair-time (MMAX) of 120 minutes to the 90th percentile for unscheduled on-site maintenance. The CCTT shall have sufficient maintenance facilities to allow alignment of the displays in a CCTT module to the performance levels specified herein within a system wide average of thirty minutes.

3.2.9.2 Qualitative maintainability.

General maintainability characteristics of the trainer shall be as follows.

3.2.9.2.1 Built-In-Test (BIT).

The CCTT BIT shall be composed of three components: (1) daily readiness check, (2) performance monitoring (PM), and (3) fault detection and locating (FL) and shall apply to all the equipment in the CCTT system. The design of controls and readout devices shall be such that they can be easily used and interpreted by maintenance personnel. The BIT shall have the capability of being fully exercised by a single operator. The circuits and devices which provide the BIT shall be designed in such a manner that failure of these circuits or devices shall not cause failure of the training device. Switches shall not be placed in series paths for purposes of introducing stimuli, diverting normal signals, nor measuring the trainer performance. The system shall provide an assessment of the overall device integrity in not more than five minutes upon command. Maximum use of the CCTT computing resources shall be made to evaluate the actual operating values against predetermined optimum performance values at no less than three points over the entire operating range for continuously variable functions and at the output of discrete functions. BIT shall function on-line, be entirely self-contained, and shall require no external stimuli nor measurement equipment. The Maintenance Console (MC) shall be the primary system console for BIT operation control. The Master Control Console (MCC) shall also have the capability to perform any of the BIT functions. Manned module and workstation status shall be available at both the MC and the MCC. In the QUICKSTART configuration, the MCC shall serve as the BIT control station. The BIT shall test the CCTT system to over 95% effectiveness. Critical communications paths shall consist of combined BIT and network monitoring functions to provide at least 95% effectiveness. Within each LRU of the image generator, approximately 99% of the components and 98% of the functionality of each component shall be tested by BIT. Each of the processors shall host a set of predominantly reused diagnostic software designed to control the BIT processing for the processor equipment itself and all additional CCTT equipment attached to its particular station or the network.

3.2.9.2.1.1 Daily readiness check.

Daily readiness check program(s) shall be designed and implemented to enable operating personnel to determine that the CCTT system is ready for operation. The program shall utilize automatic sequencing through a series of static inputs utilizing the normal iteration rate of the various program units. The Daily Readiness Check shall consist of the following steps:

1) Power On Self Tests, non-man in the loop electrical/electronic tests, shall be executed automatically by the simulators and processors upon activation of the power.
2) Each simulator shall be instantiated as an entity by the MCC (or MC) operator for the purposes of collecting power on BIT status and starting the Daily Readiness Checks.
3) The visual system monitors shall be verified that they are active with the correct image present.
4) A predefined operations checklist shall be performed to verify manned module operation.
5) The checklist status shall be reported to the MCC (or MC).
6) Each simulator shall be assigned to the exercise and set to simulator initial conditions upon completion of vehicle checklist.

The daily readiness check for steps 1, 2 and 6 shall require less than 15 minutes to complete where item 6 is performed from an existing exercise file.

3.2.9.2.1.2 Performance monitoring (PM).

The PM component shall function on-line, be entirely self-contained, and shall require no external stimuli nor measurement equipment. Normal operation of the PM capability of the host processor shall be in an energized mode continuously monitoring all circuitry with no warm-up period required. PM in the host processor shall have the capability to continuously monitor operating system anomalies and record them to an error log. Host processors, whose built in test includes parity checking and memory error detection, shall have the capability to monitor those errors continuously and record them in an error log. Errors of these types shall be logged in an error log, which shall be accessible to the system. The operator shall have the capability to readily query the error log. As a minimum, the error log shall include the following:

a. Error class
b. Error description
c. Error identifier
d. Error type
e. Timestamp

The status of communication within each network node shall be provided to the Network Manager. When PM BIT tests detect a fault and if no network fault exists, then the tests shall provide enough information to isolate to the faulty workstation/console or manned module. If a fault is detected in the network, the network manager shall be used to isolate the fault to the failing workstation/console or manned module.

3.2.9.2.1.3 Fault Localization (FL).

The FL component shall function off-line, and shall require manual initiation. Upon indication of failures of COTS equipment, diagnostic routines, procedures, test units, and other procedures from the vendor shall be used to isolate the faulty hardware to the Lowest Replaceable Unit

(LRU). For prime and subcontractor newly designed equipment and the image generator, fault locating BIT shall be provided to isolate faulty hardware as follows:

a Power supply faults shall be isolated to the failed power supply.

b As a minimum, 75 percent of all Circuit Card Assembly (CCA) faults shall be isolated to no more than one CCA, 90 percent of all CCA faults to no more than two CCAs, and 100 percent of all CCA faults to no more than three CCAs.

c Faults other than power supply or CCA faults shall be isolated to the LRU.

The status and results shall be displayed in an easily readable format on a console and printed hard copy (selectable by the operator) and shall include identification of the error and necessary corrective action. The results shall be stored in computer files which shall be accessible via display or hardcopy printout at a later time. The diagnostic operator interface formats shall be the same for every station in the CCTT configuration. The operator shall have the capability to run FL on all hardware in the station or choose to check out individual components of the station. Provisions shall be made for automatic sequencing through the tests, or portions thereof, incrementally to verify the desired output at each step. The operator shall have the option of either proceeding after he has noted the errors or stopping the computers to determine the type and nature of the failure through the use of the CRT terminal. The operator shall be able to perform the module control tests by moving the control and displays down to the specific module where the operator can control the BIT while sitting inside the module with hands-on access to each required manual control. The software and user interfaces for running local diagnostics shall be the same as for running from the MC itself. The locally executed diagnostics shall have no impact to the network as they shall be capable of running in parallel to CCTT simulations. Fault Localization shall provide the capability for the operator to run checkout diagnostics on any unused workstation or manned module at any time. The FL shall provide the capability for any particular console, at the discretion of the MC operator, to be removed from the active simulation configuration, and perform FL on it own hardware.

3.2.9.2.2 Lamps.

All lamps used in the trainer shall be replaceable from the front, unless the lamp(s) is used in the simulation of tactical equipment that does not have front accessibility.

3.2.9.2.3 Blown fuse indicator light.

When fuses are incorporated into a new design, blown fuse indicator light(s) shall be provided and shall be visible on the outside of the equipment rack when all doors are closed and when standing in front of the rack.

3.2.9.2.4 Accessibility.

Accessibility characteristics shall conform to the requirement 36 of MIL-STD-454.

3.2.9.2.4.1 Cable slack.

Adequate cable slack and cable bending features shall be provided to assure full extension access to multiple equipment extensions during maintenance. Adequate cable slack shall also be provided in the cables behind equipment panels to permit removal of each instrument, display, or control panel and disconnection from associated cables in one maintenance operation from the equipment.

3.2.9.2.4.2 Assemblies.

Units, assemblies, subassemblies, and parts shall be provided with adequate accessibility/removability for ease of maintenance. If tracks, slides or roller are provided, automatically operated locking devices shall also be provided to lock the assembly in the servicing position as well as in the fully opened (except for the equipment rack shelf) and fully closed positions. The design of each major assembly, subassembly, and unit of the CCTT system, shall permit access to its interior components and parts for maintenance. It shall not be necessary to displace or remove wires, cables, subassemblies, or assemblies in order to gain access to mounting screws, test points, adjustment points, lubricating points, and the like. Where visual inspection is necessary, and open access is not feasible, transparent access panels shall be used. The placement of parts shall be such as to provide space for the use of test probes. Assemblies subject to replacement or service shall not be permanently secured.

3.2.9.2.4.3 Wiring board extender cards.

Where connector termination points are not accessible for testing, extender cards shall be provided. Extender cards shall have matching indexing system and shall be identified with their corresponding wiring boards. Insulating materials shall not be applied to the connecting surfaces.

3.2.9.2.4.4 Covers, panels, and doors.

Hinged covers and doors shall be provided with a means to retain them in an open position; and when opened, shall not cause the equipment to become unbalanced. A chain fastened to the equipment shall be used on removable covers for which no convenient location for depositing the cover is available during maintenance. Front panels containing parts which require maintenance such as instruments, switches, potentiometers, and the like, shall provide adequate accessibility/removability for ease of maintenance. Where parts or assemblies are mounted on hinged doors, panels, or covers, electrical ground return shall not depend on the hinge contact for electrical continuity. A separate grounding means shall be provided for the electrical ground return. Locking devices shall be installed on the hinged covers and doors to retain them in the open position to permit accessibility and to prevent injury to personnel performing maintenance.

3.2.9.2.4.5 Handles (MANPRINT).

Handles and hand grips shall be provided for removing units or chassis from enclosures. Handles on enclosures shall be recessed.

3.2.9.2.4.6 Replacement of modular assemblies.

Plug-in techniques shall be used to permit replacement of modular assemblies. All modular assemblies shall be designed so that they can be inserted into the equipment in one position only. Sockets shall be oriented in the same direction and positioned so that the sockets are visible. Modular circuits shall be grouped in functional units.

3.2.9.2.4.7 Cabinet door locks.

All equipment cabinet doors equipped with key operated locks shall utilize a common key for all locks.

3.2.9.3 Circuit card design.

This paragraph and subparagraphs shall be applicable to all CCTT unique circuit cards. For economy of fabrication, maintenance, and testing, the trainer design shall use the concept of multiple application of identical cards. The minimum ratio of circuit cards to circuit cards types shall be 5 to 1, with a goal of 10 to 1. Functions shall be apportioned to cards so as to take advantage of standardization and commonality of components. The use of circuit cards exceeding 180 square inches in size shall require specific approval by the contracting officer. Unless specifically approved by the contracting officer, multilayer cards shall not exceed four layers of which the inner layers shall be used for signal carrying purposes.

3.2.9.3.1 Circuit card connectors.

Circuit card connectors shall have means of positive connection without diminishing the life of the connector under normal mating/unmating cycles. The use of circuit cards with connectors on more than one edge shall not be allowed unless approved by the contracting officer.

3.2.9.3.2 Circuit card connectors, power, and ground.

Power and ground shall be placed on the same pin number location on all card slots so that inadvertent insertion of a card in the wrong slot will not result in damage to the card or to other parts of the system. Any deviation from this requirement shall require approval of the contracting officer.

3.2.9.4 Deleted.

3.2.10 Environmental conditions.

Component parts, units, assemblies, and subassemblies of the CCTT fixed site and mobile system shall be designed to operate in accordance with the environmental performance requirements that follow. Additional shock and vibration requirements for mobile CCTT systems are specified in paragraph 3.8.3.

3.2.10.1 Standard temperature and humidity.

The equipment shall be designed to operate in an environment with a temperature range of 60 to 85^{o}F and a relative humidity of 40 to 75 percent non-condensing, unless otherwise specified.

3.2.10.2 Acoustical noise (MANPRINT).

The control of acoustical noise generation and penetration shall be in accordance with the requirements of MIL-STD-1474. The acoustical noise level in operational areas of the trainer shall not exceed the noise criteria of MIL-STD-1474. The acoustical noise level in simulator bay aisles shall be less than 81dB (Cat D in MIL-STD-1474).

3.2.10.3 Storage.

The CCTT system shall be designed such that it will not be damaged, nor shall the performance be degraded, when stored in a humidity range of 25 to 75 percent, non-condensing, and a temperature range of -25 to 125°F closed to the environment. NDI Category A and B equipment, approved by the Government, will not be damaged, nor shall performance be degraded, when stored in a humidity range of 25 to 75 percent non-condensing, and a temperature range of 0 to 125 degrees F closed to the environment.

3.2.10.4 Vibration.

The CCTT system shall be designed such that it will not be damaged, nor shall the performance be degraded when it is subjected to vibrational stresses produced during shipment and normal use.

3.2.10.5 Shock.

The CCTT system shall be designed such that it will not be damaged, nor shall the performance be degraded when it is subjected to infrequent nonrepetitive shocks or transient vibrations encountered during handling, transportation, and service environments.

3.2.11 Transportability.

CCTT system components shall be designed to be transportable to the installation site by standard commercial transportation. The CCTT system shall be constructed such that installation and assembly can be accomplished and disassembly of the training system can be accomplished without the necessity of soldering, welding, unsoldering, cutting, crimping, or destruction of material.

3.3 Design and construction.

3.3.1 Materials, processes, and parts.

All material and equipment used in each CCTT system other than Non-Development Items (NDI), as defined in the Statement of Work, shall follow the requirements of appendix B of this specification. The visual image generator shall be exempt from NDI and Trainer Unique Equipment (TUE) requirements. The image generator shall, however, be an extension of an existing NDI image generator product line (see appendix A.30.3.2).

3.3.2 Electromagnetic radiation.

3.3.2.1 Electromagnetic compatibility (EMC).

No wireless communications shall be used within the CCTT system.

3.3.2.2 EMC electrical grounding.

Deleted

3.3.2.3 Not Used

3.3.2.4 Trainer System Electrostatic Discharge (ESD) effects.

Deleted

3.3.2.5 Wire and cable.

Deleted

3.3.3 Safety and health hazards (MANPRINT).

The CCTT system shall be designed to be safe and free of hazards to all personnel. Any safety or health hazards associated with any phase of operation to include installation, operation, maintenance, testing, storage, transportation, and disposal shall be eliminated or its associated risk controlled to a level acceptable to the Government. Design shall be in accordance with paragraph 4 of MIL-STD-882 and comply with requirements of MIL-STD-1474.

3.3.3.1 Electrical safety.

Electrical circuitry shall comply with the requirements of the National Electric Code and MIL-STD-454 (requirement 1, personnel safety and requirement 8, electrical overload protection). The main power switch shall be located in front of the system, clearly labeled, and shall cut off power to the complete CCTT system. Internal protective measures shall be as defined in table 1-II of MIL-STD-454. Danger, caution, and warning signs shall be designed and used in accordance with ANSI Z535.3-1991 and ANSI Z535.4-1991 to warn user personnel of specific hazards such as voltage, current, and thermal. For GFE/existing vehicles used within CCTT, warning signs already designed/approved for such vehicles will be used. For potentials between 70 and 500 volts warning shields and sign labels shall read ”CAUTION (insert maximum voltage) VOLTS”. Circuit breakers shall be on the equipment side of the power switch and shall be capable of manual reset only. Computer equipment shall meet the requirements of Chapter 4 of NFPA 75, except that flexible AC power cords shall not exceed 25 feet in length. Batteries shall be sufficiently separated from electronic components to prevent damage from corrosion. In addition, grounding wands shall be provided and installed in each equipment rack where an interlock circuit is installed because of residual electrical charges. The wands shall be permanently wired to the equipment ground system.

3.3.3.2 Personnel safety.

The design of the CCTT system shall be such as to provide maximum safety to personnel and system equipment when installing, operating, transporting, adjusting and maintaining the equipment. The CCTT system shall not exceed steady state or impulse noise levels defined in MIL-STD-1474. The design shall also meet requirements 3 and 9 of MIL-STD-454. The following paragraphs of MIL-STD-1472 shall apply: 5.7.8 for ingress/egress; 5.8.1.2 for ventilation; 5.9.11.3 for weight limits and weight labeling; 5.9.11.5 for handles and grasp areas; and 5.13 for hazards and safety requirements. Where COTS equipment is used, if commercial (e.g., UL) safety standards are met, then the COTS equipment need not be modified, except by labeling to meet the additional safety requirements stated in this section. Fire extinguishers shall be provided for all confined space areas as well as be easily accessible within the facility as described within Code of Federal Regulations, Title 29 (Occupational Safety and Health Standards). Emergency power off switches shall be provided that can easily be reached by all operator personnel in the event of an emergency.

3.3.3.3 Hazardous materials.

The CCTT system shall not incorporate any asbestos. Glass fiber materials shall not be used as the outer surface or covering on cables, wire or other items where they may cause skin irritation to operating personnel. When maintenance procedures require access to glass fibers, such as insulation, a proper caution note shall be provided. PVC materials shall not be used in the crew compartment. The CCTT system shall preclude exposure of personnel or the environment to excessive levels of toxic, carcinogenic, or otherwise hazardous materials as defined by the (OSHA), (EPA), and the (DOT).

3.3.3.4 Mechanical safety.

Moving parts shall be guarded or provided with safety devices to prevent mechanical injury to operator and maintenance personnel. Edges and corners shall be rounded and free from burrs.

Center of gravity shall be such that the system is easy to handle; the system shall be stable. A means shall be provided to lock/disengage the wheels of applicable equipment, so the system can not be inadvertently moved.

3.3.4 Human performance/human engineering (MANPRINT).

Software shall be user friendly to the extent that the system users identified in section 3.5 of this specification will be able to competently operate system equipment. Simulated work spaces, positions and environments for personnel shall be representative of the operational system equipment incorporating recommendations from the CCTT Fidelity Analysis. Simulated equipment shall replicate operational equipment locations and functions incorporating recommendations from the CCTT Fidelity Analysis. The workstation operator workload shall not exceed the parameters determined by appropriate manpower analysis. The design of the CCTT system, exclusive of simulated feature fidelity, shall be in conformance to applicable provisions of the human factor engineering criteria and requirements of MIL-STD-1472 (not to include paragraphs 5.7.8.1 (M2A2,M3A2 only), 5.10, 5.11, 5.12 and 5.14). All aspects of the CCTT system, except those portions which replicate actual military hardware, shall be governed by the dimensional range from the 5^{th} percentile female to the 95^{th} percentile male soldiers working with the system. Design, selection, and arrangement of equipment shall ensure ease, efficiency, and safety of operation in the performance of all necessary functions by the crew and other personnel in fulfilling the intended use of CCTT. Factors causing simulation sickness, per Simulator Sickness Field Manual Mod 3, and fatigue shall be reduced to a minimum. Work space and positions for the TOC and ALOC shall be representative of operational counterpart stations, fixed and mobile. Crew station fidelity design developed under the concept of providing only what is necessary and essential for the task shall assure limitations and fidelity are not contributing factors in crew fatigue.

3.4 Logistics.

The logistics support concept for CCTT shall be total contractor logistic support (CLS).

3.5 Personnel (MANPRINT).

The crews to be trained on the CCTT system will be fully MOS qualified for the position occupied in CCTT. No special aptitudes or training shall be required of the soldiers. Training target audience for the CCTT shall be:

a. MOS 11B Infantryman.

b. MOS 11C Indirect Fire Infantryman.

c. MOS 11H Heavy Anti-armor Weapons Infantryman.

d. MOS 11M Fighting Vehicle Infantryman.

e. MOS 12B Combat Engineer.

f. MOS 13F Fire Support Specialist.

g. MOS 19D Cavalry Scout.

h. MOS 19K M1 Armor Crewman.

i. MOS 31C Single Channel Radio Operator.

j. MOS 54E NBC Specialist.

k. MOS 96Z Intelligence Senior Sergeant.

l. MOS 76Y Senior Logistics Sergeant.

m. SC 11, Infantry Officer.

n. SC 12, Armor Officer.

o. SC 13, Field Artillery Officer.

3.5.1 Training (MANPRINT).

The Target Training Audience shall be able to operate the CCTT system upon completion of familiarization training to account for the differences between the trainer and the vehicle being simulated. Familiarization training shall utilize classroom training and practical exercises. All Operations Center workstation system operators shall be personnel fully trained at Military Occupational Specialty (MOS) skill levels. Workstation personnel shall receive one hour of CBT for their applicable station excluding the MCC, MC, AAR, and SAF workstations. This one hour of CBT shall provide them with sufficient training and familiarization to enable them to perform their intended mission during an exercise. Exercise initialization parameters shall be within the skill capabilities of unit personnel. The operator interface shall provide the capability of one-person initialization. The CCTT shall promote inculcation of only safe operator procedures. The CCTT shall provide fidelity by which crews will be able to conduct procedural training to reinforce safety procedures on the actual systems.

3.5.2 Manpower (MANPRINT).

The CCTT will not require additional Government assets for training. No additional MOSs will be required for operation. Trainer personnel will be drawn from existing instructor resource pools at the institutions and installations. The CCTT system hardware and software must be user friendly to the extent that the Target Audience shall be able to competently operate the CCTT system with no more training than that noted above.

3.6 Module parameters and design requirements - generic (MANPRINT).

The following requirements shall be applied in the design and fabrication of all manned modules and specific positions within the manned modules.

a. NBC Gear - The CCTT manned module designs shall allow the crews to wear NBC gear (M25, M40 and M17 series individuals protective mask, microclimatic vest, and the chemical protective overgarment worn over individual clothing) and hook up to the gas particulate system (providing conditioned fresh air flow IAW MIL-STD-1472) during a training exercise and not encumber personnel any more than occurs in the operational equipment. This is applicable not only to the compartment but the use of the simulated controls and communications.

b. Interior Illumination - Simulation of natural ambient illumination of the compartment interior shall be provided excluding natural ambient illumination as a result of a popped hatch condition. Interior illumination shall be Night Vision Goggle (NVG) compatible if actual operational NVG devices are utilized

c. Combat Vehicle Crew (CVC) Helmets - The design of the CCTT manned modules shall ensure that CVC helmets can be worn at all crew positions without restriction of movement or degradation in ability to operate controls normally.

d. Simulated Compass - Each manned module shall provide a compass simulation, presented in degrees, (mils for the M981 FIST-V) depicting the orientation of the long axis of the vehicle (or the direction facing for dismounted infantry) on the simulated terrain to grid north. For manned modules except DI, the simulated compass shall be located inside the compartment. The correct directional compass reading shall be available within a manned module only after a simulated vehicle has been stationary for 60 seconds. For the dismounted infantry, the compass shall be available at all times, when in the dismount mode.

e. Module Compartment Tolerances - The CCTT manned module compartments shall be designed based upon published data, manufacturer drawings, and data gathered by the contractor on actual baseline vehicles. Space constraints within the compartments and the interior dimensions shall be within 2.5 inches of the actual vehicle.

f. Physical/dimensional characteristics - The replicated components within the modules shall be dimensionally accurate to within +/- 0.25 inches. Items which are non-functional and non-tactile (i.e. viewable by the student but not touched during training) shall be dimensionally accurate to within 5 percent.

g. Component placement - Placement of module components within the compartment shall replicate the location within the baseline vehicle to an accuracy of +/- 1.5 inches. Distances between adjacent components including panels shall be within +/- 0.25 inches.

h. Indication Response - The simulated instruments, gauges, lights, and displays, shall duplicate the performance of the baseline vehicle within +/- 10 percent. Rates of change and lags normally experienced in the operational environment shall be replicated in the CCTT manned modules indicators and display responses.

i. Control response - Controls which are required for target acquisition or for driving the vehicle shall meet the dynamic and kinematic fidelity requirements of paragraph 3.6.4. Components which are not required for target acquisition, tracking, weapons firing, and driving shall exhibit control responses which are within 15 percent of the operational equipment.

j. Not Used.

k. Emergency Compartment Lighting - Each CCTT manned module compartment shall provide battery powered emergency lighting which automatically activates in the event of a power failure to the compartment. The emergency lighting system shall be self charging with a charge indicator. The system shall provide sufficient lighting in the compartment interior for a minimum of 15 minutes.

l. Module Fire Detection System - Each CCTT manned module compartment shall provide a fire detection system which detects the onset of possible emergency. The system shall meet the NFPA Code 101 for the design of the fire detection system and shall meet NFPA 70 and 72 (Aug 1993) for the installation, test, and maintenance of the system. Components used in the fire detection system shall be UL approved. The system shall also meet the following:

m. Power and signal cable groups shall be isolated from fire alarm cables.

n. Activation of the module fire detection system shall sound an alarm inside the module compartment(s) and shall trigger internal alarms in compartments of all modules.

o. A strobe light shall illuminate on top of the module exterior and shall be visible. Activation of one module's fire detection system shall not trigger strobes on any other modules.

p. A power interrupt indication shall be displayed on the MCC and MC.

q. The fire detection system shall provide an output interface for the facility fire alarm system and shall trigger the facility alarm.

r. Activation of a module's fire detection system shall deactivate power within the module.

s. Each module's fire detection system shall incorporate a battery backup ability that will allow the fire detection system to remain operational for a minimum of twenty four (24) hours after the removal of power.

t. Activation of the Facility Fire Detection System shall not trigger strobes on any modules.

u. Activation of the Facility's Fire Detection System shall activate the internal alarms in all compartments and all modules.

v. Emergency Power Disconnect - Each CCTT manned module compartment shall provide an emergency power disconnect button. The button shall be lighted and covered with a safety panel to preclude accidental activation. The module shall be capable of subsequently being powered-up and reconstituted into the data base in the appropriate position and condition within the exercise only after the disconnect has been reset at the module.

w. Turret/Hull Reference Indicator - For vehicles with turrets, the module shall display the direction/orientation of the turret relative to the hull. The indicator shall be visible to the gunner and commander.

x. Module Identification - Module identification shall be provided on the exterior of each module which describes the exercise number, and vehicle identification number. The display (e.g. liquid crystal display, CRT or light emitting diode) shall be controlled through initialization of the exercise.

y. Crosstalk between simulator sound systems shall be minimized through the use of materials which have acoustic attenuation and isolation properties. The acoustical attenuation between closed simulators shall be a minimum of 30 dB.

3.6.1 Damage and failure.

The DI module shall only be subject to combat damages and deterministic failures as indicated in 3.6.1.5. The M1A1, M1A2, M2A2/M3A2, M981 FIST-V, M113A3 APC, and HMMWV modules shall be subject to three categories of failures, which are:

a. Combat damage.

b. Stochastic failure.

c. Deterministic failure.

Crews shall be made aware of the vehicle failures only to the extent that the associated changes to control responses, lights, gauges, sounds, and visual observation provide to the crews. The equipment shall reflect the inflicted damage by partially or fully disabling (or degrading) the vehicle subsystems and controls. Information discernible only through this equipment shall be provided to the crews.

3.6.1.1 Combat damage.

Combat damage shall be simulated for all entities in the battlefield. Combat damage shall be defined as damage inflicted when a vehicle, aircraft, and/or personnel receive either the effects of mines, exploding ordnance, or direct, or indirect fire from opposing and friendly forces during the battle simulation. The location of the hit on the vehicle, range, angle, the type of ammunition used, and damage probabilities shall determine which failures occur. Combat damages shall include the percent of crew members killed or wounded, as well as vehicle damage sustained. Several different failures shall be possible at a given hit location and the occurrence of a particular failure shall be based on the probability given for each failure at that particular hit location. Time to repair damage shall be determined by using actual Mean-Time-To-Repair (MTTR) data. A means shall be provided within each module to display crewman casualty for all crew members within the module. The display shall be visible to all crewmembers and shall include both wounded and killed states.

3.6.1.2 Stochastic failures.

A stochastic failure occurs when the vehicle or equipment fails on its own, not through crew error or combat damage. The frequency of failure shall be determined by the Mean Time Before Failure (MTBF) or Mean Miles Before Failure (MMBF) for the particular vehicle, based on available data. Stochastic failures shall degrade the performance of the vehicle.

3.6.1.3 Deterministic failures.

Deterministic failures are failures that occur due to resource depletion or improper action. Deterministic failures include, but are not limited to, mismanagement of fuel and ammunition, collisions, thrown tracks (resulting from improper high speeds and turns on soft surfaces, and attempting steep inclines beyond the capability of the system), resource depletion, and ignored stochastic warnings by the crews.

3.6.1.4 Areas of potential failures.

The CCTT shall provide malfunctions and failures for the areas below. Each occurrence shall be based upon statistical data for combat, deterministic, and stochastic failures.

a. Transmission.

b. Engine.

c. Weapon systems.

d. Turret.

e. Fire Control Systems.

f. Electrical systems.

g. Communications.

h. Tracks or Drive Trains or Wheels.

i. Control Panels or Displays.

3.6.1.5 Dismounted infantry failures.

The simulated dismounted infantry shall be subject to two categories of failures. These are:

a. Combat fatalities or casualties.

b. Deterministic failure.

c. Combat fatalities for the dismounted infantry occur when the squad or platoon receives either a direct or indirect fire hit, or mine effects. The location of the hit, the type of ammunition used, and the kill zone, shall determine the extent of the injury. The wounded shall impact the functioning of the squad by reducing movement speed and shall reduce the DI's ability to employ the weapons listed in 3.7.10.2.1. Deterministic failures for DI shall be limited to depletion of the ammunition and weapons resources specified in 3.7.10.2.1.

3.6.2 Simulated repairs.

Simulated repairs for CCTT shall be classified into two categories: a) Self-repairs which represent those repairs that the crew can perform on their own without assistance, and b) Repairs via the UMCP simulation in which the crew must coordinate with the dispatcher via radio to arrange a rendezvous with a repair maintenance vehicle to repair the vehicle. Both classes of repairs are timed using MTTR data. The total repair time for each occurrence shall be the summation of repair times for all subsystems of the vehicle requiring attention. The crew shall be notified by the system that repairs are completed.

a. Self-repairs shall commence upon crew request of those damages or failures to the vehicle and shall represent repairs that a crew could accomplish themselves. The following are examples of self-repairs:

(1) Repairing thrown tracks.

(2) Repairing laser range finder

(3) Repairing main gun misfire

b. Repairs via the UMCP shall occur when a vehicle subsystem fails and cannot be fixed through self-repairs. The vehicle crew shall determine the damage, relay the information to the UMCP, and arrange a rendezvous with a repair maintenance vehicle. If the repair maintenance vehicle cannot repair the vehicle then the damaged vehicle will be towed to the UMCP by one of the recovery vehicles listed in paragraph 3.7.1.3. If during the repair, either the damaged vehicle, or the maintenance vehicle drives away or is destroyed, the current item under repair and the items not yet repaired when the vehicle is displaced or destroyed shall remain in a failed state.

3.6.3 Not used.

3.6.4 Dynamic and kinematic fidelity for manned simulators.

In order to avoid negative training, the manned modules must provide sufficient fidelity of vehicle dynamics, kinematics and controls. CCTT shall provide simulation of the dynamics of the manned tracked and wheeled vehicles based upon the solution of six degree-of-freedom (x,y,z, pitch, roll, and yaw) equations of motion using simultaneous differential equations. The simulation shall result in the steady-state and dynamic motion of the vehicle in the terrain database within the tolerances specified below unless otherwise specified in an appendix for a particular vehicle.

a. Velocity and acceleration. The vehicle simulation shall replicate the velocity and acceleration due to accelerator position, brake pedal position, transmission selection, malfunctions, and terrain. Maximum velocity shall be within 10% of actual vehicle performance. Acceleration shall be within 15 percent of the actual vehicle subject to a lower bound of 0.3 meters per second squared.

b. Engine. The simulated vehicle shall include all functions of the engine required for simulation of the speedometer (+/- 2 MPH), tachometer (+/- 100 RPM), aural cues related to engine speed, output torque, and engine malfunctions and warning systems.

c. Transmission. The vehicle simulation shall model the output torque and torque/speed ratio as a function of shift lever position, accelerator position, engine output, load, RPM, malfunctions, and terrain. All transmission control positions shall be simulated and functional.

d. Starting system. Each manned module shall provide the controls and indicators required to start the engine. The simulation shall replicate the steps required by the operator, time sequences (+/- 1 second), and RPM (+/- 500 RPM).

e. Braking system. The braking system for each of the vehicles shall be modeled. Braking distances and deceleration rates shall be simulated based upon terrain, transmission selection, and pedal displacement (+/- 15 percent). Control force for pedal deflection shall be replicated (breakaway and ending forces for each vehicle are specified in the appropriate PIDS appendices).

f. Steering. The feel and response of the vehicle's steering system shall be provided. Deadband shall be within 3 degrees of the actual vehicle. The turning radius shall be replicated within fifteen percent for given speeds and steering control positions. The rate of turn based upon steering position, velocity, transmission selection and terrain shall be within 15 percent. The differential steering system for tracked vehicles shall be modeled to include the power distribution and control to the tracks.

g. Suspension. The vehicular movement (pitch and bounce) due to the terrain and suspension shall be replicated in the own visual scene within 20 percent. The dynamic simulation shall add additional "undulation" to the own vehicle dependent upon terrain type. (This undulation is required to overcome limitations in terrain granulativity).

h. Trafficability. The traction of the vehicle tracks or wheels shall be simulated for all database weather and terrain types. This shall provide a simulation of trafficability including the real world limitations due to slope (+/- 5 degrees), obstacle height (+/- 6 inches) or terrain type.

i. Tracks. The simulation shall provide for tracks about to be thrown (popping sound) and thrown tracks (loss of steering control, hard veering when braking) due to improper driver control. Improper control shall include laterally attempting too great a slope, and high speed, hard turns in soft soil terrains.

j. Terrain following. The simulation shall provide for terrain following which models each own vehicle wheel or track. The own vehicle shall follow the terrain contours to within 0.15 meters within the confines of the vehicle suspension model.
k. Fire control systems. The vehicular fire control systems shall be replicated to allow precision gunnery techniques and degraded mode gunnery techniques (e.g. gunner's auxiliary sight, and manual traverse and elevation handles). Limits of travel shall be within 8 degrees for rotational travel and one inch for linear travel. Control forces shall be simulated (+/- 1.0 pounds breakaway force, +/- 2.0 pounds ending force). Laser range finders shall be simulated to include accuracy (+/- 3 meters), the range indications in the sight and multiple return indications. Laser designators shall be replicated in terms of effective range accuracy (+/- 3 meters) and function. The simulation of the reticle for the M1 family of vehicles shall include the reticle jump.
l. Turret and cupola dynamics and kinematics. The CCTT shall simulate the turret and cupola dynamics of the M1 family of vehicles, M2A2/M3A2, and FIST-V. The simulation shall interface with the hull simulation. Turret orientation shall be displayed in the visual scene. Turret movement shall be in response to crew member control inputs, motion transmitted from the hull simulation, and the stabilization and elevation systems. The simulation shall include stabilization systems, rotation rates, gun elevation rates, kinematics, and dynamic modeling within 10 percent.
m. Missile dynamics. The dynamic simulation of the missile fly-out (velocity, lateral and vertical acceleration, trajectory, range) shall be provided for those missiles visible in the database (e.g. TOW, Dragon, Copperhead). For missiles controlled by gunner inputs, the simulation shall accurately model the missile response to gunner controls within +/- 10%. If the gunner control inputs a change in azimuth or elevation which is greater than the capability of the missile to change direction the gunner shall lose control of the missile. For wire guided missiles, the simulation shall replicate broken wires and loss of line-of-sight. The interaction between laser designators and laser guided missiles shall be simulated. The visual simulation shall include missile launch signature, gunner's sight obscuration after launch, flare in the rear of the missile both in the gunner's sight and on the battlefield, and impact visual effects.

3.6.5 Emulated vehicles fidelity.

The accuracy of the movement of entities in the visual database (i.e., visual models) is not as critical as the accuracy of movement of the crew member's visual scene (e.g. tank pitch due to recoil, and suspension action due to terrain). This allows for less complex dynamic models with larger tolerances for these emulated vehicles.

The emulated vehicle models shall simulate the movement of the ground vehicles, aircraft, dismounted infantry (DI), and guided weapons to allow the visual model of the entity to be correctly displayed in the visual scene. The simulation shall provide terrain following for the emulated visual models of ground vehicles and DI's on the terrain database. The simulated vehicles and DI's shall not have floating nor digging effects visible in the visual scene in accordance with the tolerance specified below. Movement of ground vehicles and DI's within the visual database shall be influenced by the simulated terrain. This movement shall be based upon slope, terrain type, and obstacle height. The movement of ground vehicles within the visual database shall be influenced by their own mass and other entities' mass in the case of towing or colliding with another model. Aircraft movement shall be limited by tree tops and other obstacles as represented in the terrain database. The ground tracked vehicle models shall simulate thrown tracks as a function of vehicle speed, terrain slope, soil type, and a probability factor for this event to occur. The simulation shall result in the steady-state motion of the vehicle in the terrain database within the tolerances specified below:

3.6.5.1 Velocity

For ground vehicles, the calculated maximum longitudinal velocity shall be within a +/-20% tolerance of approved and available performance data for a given ground vehicle and terrain type. The tolerances shall be measured as the percent difference between the commanded and the steady state calculated longitudinal velocity. However if the commanded velocity exceeds the maximum allowable and achievable velocity on the terrain, then the tolerances shall be measured with respect to this maximum velocity.

3.6.5.2 Acceleration.

For ground vehicles, the calculated longitudinal straight line maximum acceleration shall be within +/- 20% tolerance of approved and available performance data for a given ground vehicle and terrain type. The tolerances shall be applied to the time it takes for a ground vehicle to achieve a commanded maximum velocity. However if the commanded velocity exceeds the maximum allowable and achievable velocity on the terrain then the tolerances shall be measured with respect to this maximum velocity.

3.6.5.3 Turn rate.

For ground vehicles, the calculated turn rate (yaw) shall be within +/-20% tolerance of an approved and available performance data for a given ground vehicle and terrain type. The tolerances shall be measured as the percent difference between the commanded and the steady state calculated turn rate. However if the commanded turn rate exceeds the maximum allowable and achievable turn rate on the terrain then the tolerances shall be measured with respect to this maximum turn rate.

3.6.5.4 Climb, Dive, Roll rates.

For aircrafts the calculated climb, dive, and roll rates shall be within +/-20% tolerance of an approved and available performance data for a given aircraft. The tolerances shall be measured as the percent difference between the commanded and the steady state calculated rate. However if the commanded rate exceeds the maximum allowable and achievable rate then the tolerances shall be measured with respect to this maximum rate.

3.6.5.5 Deceleration.

For ground vehicles, the calculated longitudinal straight line maximum deceleration shall be within +/-25% tolerance of approved and available performance data for a given ground vehicle and terrain type. The tolerances shall be applied to the time it takes for a ground vehicle at a given speed to stop.

3.6.5.6 Slope

The maximum slope that a ground vehicle can negociate shall be within +/- 5 degrees of approved and available vehicle performance data.

3.6.5.7 Obstacle Height.

Terrain features which cause collisions will not be traversable. Terrain features which do not cause collisions will be traversable.

3.6.5.8 Terrain following.

The simulated ground vehicles and DI's shall follow the terrain contours to within an accuracy of 0.3 meters.

3.6.6 Ballistics.

The ballistic simulation of each weapon and ammunition type shall replicate the visual characteristics of the firing signature, trajectory flyout, and the impact signature. The trajectory flyout shall match the data found in government firing tables. The hit probability, and damage computations of the actual weapon or ammunition for all entities shall be simulated as part of the ballistics simulation. The hit detection computations shall take into account round-to-round performance variations along with how close the selected target was to the computed trajectory of the fired ammunition. Hit detection shall detect a hit within a 1.5 meter square area of the particular vehicle surface. The performance capabilities and visual representation of the selected target shall be modified to account for any occurrence of damage.

The rate of fire of the modeled weapon shall replicate that of the actual weapon.The CCTT dismounted infantry unit shall be subject to the same resource limitations as actual field units.The resources shall be selected and controlled in accordance with the established initial conditions of the exercise and the capabilities of resupply sources.

The firing of the Smoke Grenade SALVOs on the different weapon systems shall be simulated. The Smoke Grenade SALVOs shall be simulated along an arc 30 meters from the particular vehicle/weapon, 55 degrees to the left and 55 degrees to the right of the gun line (the gun line is an imaginary line drawn from the base of the gun barrel along the center of the barrel out to the desired range on turreted systems) for vehicles with 6 tube launchers and 52.5 degrees left and right for vehicles with 4 tube launchers. In the case of those vehicles where the smoke grenade launcher is a part of the hull then the smoke simulation shall be along the vehicle center line, which is an imaginary line from the rear of the vehicle through the center of the vehicle out to the desired range.

3.6.7 Simulated ammunition transfer.

The modules shall provide the crew with the means to simulate the transfer of ammunition from ammunition prestock which has been placed in the database, from supply vehicles, or from other manned vehicles. This capability shall provide the ability to choose the type of ammunition and shall indicate the type and number of rounds transferred. A means to transfer from vehicle ammunition storage areas to the "ready rack" shall also be provided. The number of available rounds for each weapon type shall be indicated to the crew. The time to transfer rounds shall replicate the real world times (e.g. time for soldiers to transfer from vehicle to vehicle, or within areas inside the vehicle). The crew shall be made aware when the transfer is complete and shall have the capability to terminate the transfer at any time. Partial ammunition loads shall be possible as a result of terminated transfers.

3.6.8 Towing Fidelity.

A manned vehicle simulator shall have the capability to tow another tracked or wheeled vehicle on the simulated battlefield, within the towing operational limits of the manned vehicle simulator. The manned towing vehicle simulator shall use a trainer unique interface to initiate the tow connection to a manned or emulated vehicle. A tow connection initiation shall be prevented unless the vehicles are within 11 meters center point to center point of each other and the towing vehicle is within +/- 45 degrees of the forward longitudinal center-line of the vehicle to be towed. After the tow connection has been made, the manned simulator acceleration and velocity shall reflect the additional load of the vehicle being towed. Simulation of towing shall be unaffected by the state of the manned, towed vehicle simulator controls. Failures of the simulated tow bar or cable shall not be simulated.

3.7 Major component characteristics.

3.7.1 Operations Center (OC) (MANPRINT).

The OC shall be comprised of replicated work areas for the battalion staff functions consisting of a Tactical Operations Center (TOC), a Combat Trains Command Post (CTCP also known as ALOC), a Field Artillery Battalion Tactical Operations Center (FABTOC), a Unit Maintenance Collection Point (UMCP), two mortar Fire Direction Centers (FDC) and a Tactical Air Control Party (TACP). The work areas shall be configured to replicate a generic version of a fielded heavy battalion task force command post. The work area shall provide the battalion staff a realistic setting within the framework of CCTT for performing their respective functions. The M577A2 enclosures shall include replicated work surface areas, shelves and non-folding table leaves, racks and shelves for communications equipment, lighting, rear door, and ramp. OC Workstations shall be able to share printers over the network. The tent-extensions shall have removable side walls to allow reconfiguration of OC areas into alternate configurations. The OC/M577A2 enclosures shall be protected by a fire detection system meeting the requirements of paragraph 3.6.j for the manned modules. The OC items shall provide communications including 36 CCTT SINCGARS radios (which can be used as radios or remotes), 36 handsets, and 36 external speakers to allow intercommunications to appropriate modules and consoles and is portable and relocatable among OC facility components. The included equipment shall be consistent with the baseline heavy battalion task force table of organization and equipment.

The OC shall be capable of supporting both single and multiple exercises as described in paragraph 3.2 without any physical modifications to the OC consoles. Each OC console shall provide a plan view display capability. Each OC console shall support multiple OC functions (for example, FSE, FABTOC) concurrently. Each OC console (excluding the TACP console) shall be capable of providing any OC function, including the TACP CAS capabilities, but excluding the TACP DI and visual capabilities. The TACP console shall be capable of providing any OC function, except that the TACP DI and visual display capabilities are provided only when the TACP function is the only function assigned to the TACP console. These capabilities shall be provided through consoles and communication equipment described in this specification for the specific following areas. The fixed site OC shall provide the capacity for 48 voice channels that can be used concurrently with each OC console having the capacity to support at least 6 voice channels. The mobile OC consoles shall provide the capacity for 12 voice channels that can be used concurrently. The mobile OC shall provide 8 CCTT SINCGARS radios, 8 external speakers, and 8 handsets. The placement and movement of the TOC, ALOC, FABTOC, UMCP, FDCs and TACP shall be represented on the battlefield with appropriate visual representations. OC vehicle movement limitations shall be imposed by the appropriate performance information for the actual vehicles.

In all cases, each item of the OC shall be visible in the database at all times and shall be vulnerable to the effects of the enemy, collision, weather, and stochastic and deterministic failures. The OC items shall be relocatable by: (1) the MCC operator, as requested by the training unit commander or his staff, (2) the console operator, and (3) by tethering to another vehicle. While being relocated by the console operator or by tethering to another vehicle, the vehicles shall be visible and shall match realistic speeds based upon terrain and weather. The TOC shall be relocatable by the OC CES workstation operator and by the OC FSE workstation operator. The vehicles dispatched by OC consoles shall be visible in the database at all times, including while moving, and shall exhibit the same characteristics and limitations of the actual vehicles they represent. Each emulated vehicle shall be susceptible to combat damage in accordance with 3.6.1.1, collision damage, weather, time, and terrain effects and shall simulate stochastic failures in accordance with 3.6.1.2.

The resources for fixed site OC capabilities shall have a capacity to simultaneously support up to 301 entities total for all exercises. The resources for mobile OC capabilities shall have a capacity to simultaneously support up to 100 entities. The system shall support the following types of OC emulated entities and, for an exercise, support up to the following quantity of each type of OC emulated entity:

OC:

3 - M577A2 for the TOC (1 for S2, S3, and FSE)

1 - M577A2 for the CTCP

2 - M577A2 for the FABTOC

1 - M577A2 for the FDC A

1 - M577A2 for the FDC B

1 - M998, HMMWV for the UMCP

CTCP:

16 - M978 HEMTT (Heavy Expanded Mobility

Tactical Trucks) (FuelTruck)

15 - M977/M985 HEMTT (Ammunition

Truck)

1 - M1091 MTV (POL) Tanker

UMCP:

Maintenance Vehicles:

5 - M113A3 (Personnel Carrier)

7 - M1078 LMTV (2.5 Ton Truck)

7 - M1079 LMTV Van

7 - M1083 MTV (5 Ton Truck)

Recovery Vehicles:

7 - M88A2 Recovery Vehicle

1 - M984A1 HEMTT Wrecker

1 - M1089 MTV Wrecker

CES:

2 - M728 CEV (Combat Engineer Vehicle)

4 - LNCHR AVLB M60A1 Series (Armored Vehicle Bridge Launcher)

5 - M9 ACE (Armored Combat Earthmover)

4 - M58 A3 MCLIC

2 - VOLCANO (mounted on an M1083 MTV)

9 - M113A3 (Personnel Carrier)

9 - US DSMT ENGR Pers, 8 Pers (1 team per M113A3)

FDC:

6 - M1064 CARR Mort w/BMS 120

FABTOC:

24 - M109A5/M109A6 SP HOW (155mm Self-Propelled Howitzers)

24 - M992 FAASV

9 - M270 MLRS (Multiple Launch Rocket System)

TACP:

100 - A10, F16

The OC shall consist of the following:

a. CTCP (also known as ALOC)
b. Combat Service Support (CSS) (3.7.1.1).
c. TOC (3.7.1.2).
d. Combat Engineering Support (CES) (3.7.1.2.1).
e. Fire Support Element (FSE) (3.7.1.2.2).
f. UMCP (3.7.1.3).
g. FDC (3.7.1.4).

h. FABTOC (3.7.1.5).

i. TACP (3.7.1.6).

j. Higher Headquarters Workstation (3.7.1.7).

3.7.1.1 Administrative Logistics Center (ALOC) (MANPRINT).

The Combat Trains Command Post (CTCP also known as ALOC) shall provide simulated CSS operational capabilities and functions via a console and communication system that allows for the control of resources associated with personnel and logistic support. The logistics support shall include providing ammunition and fuel to requesting units. Control over the battalion's ammunition and fuel supply trucks shall be through the CSS console responding to requests for support. The CSS shall simulate (types and numbers to be predetermined during initial conditions generation) fleets of fuel trucks and ammunition trucks. The fuel trucks simulated shall be as specified in section 3.7.1. The ammunition trucks simulated shall be as specified in section 3.7.1. The performance/limitations of the resupply vehicles shall replicate the capabilities of the actual vehicles specified in section 3.7.1 to include vehicle speed limitations, weight capacity, and tank capacity/range. While a vehicle is undergoing operator maintenance (self-repair), supply transfers shall be allowed provided that all other criteria for the supply transfers are met. The CSS shall be able to transport via HEMTT up to 12 mine rollers and 12 mine plows. The dispatched vehicles shall automatically travel to the dispatched location utilizing the most tactically appropriate routes based on terrain that is trafficable unless a specific route is designated by the CSS operator. The CSS console shall display the initial status for all support vehicles showing what supplies and amounts are available, and breakdowns if any have occurred. The CSS console shall display updated status for all support vehicles showing supplies and amounts that are available, and breakdowns that have occurred only if the console operator requests the data updates. The CSS vehicles shall, when directed by the CSS operator, displace by the following methods:

a. Follow a HMMWV as described in 3.7.14

b. Travel independently based on explicit directions from the CSS work station.

c. Travel independently based on predefined routes (i.e. Major Supply Routes).

d. Relocate automatically to the designated location via the most tactically appropriate route considering vehicle capabilities and performance.

The dispatched trucks shall be visible in the CCTT database and shall acknowledge (resupply) the requesting vehicle or dismounted element if the requestor is within 20 meters of the supplier vehicle for a service station resupply or within 100 meters of the supplier vehicle for a tailgate resupply. After the requesting vehicle or dismounted element is serviced (or if it is not there), all other vehicles or dismounted elements that are within 200 meters from the appropriate supplier vehicle shall be serviced upon request if consistent with supply procedures. The dispatched trucks shall then be capable of being redirected to other locations. At any time, the operator at the CSS console shall either direct the supply truck to service another vehicle, stay where it is, or return back to the point of origin for resupply. The capability to transfer supplies from one resupply truck to another shall be provided utilizing Army standards as time limits. The CSS shall be able to access ammunition and fuel prestock. The CSS shall also be able to transfer ammunition and fuel stock between the truck and prestock(s) in the database.

3.7.1.2 Tactical Operations Center (TOC) (MANPRINT).

The TOC shall consist of the XO, S-2 and S-3 battalion staff work areas, the combat engineering support function, and the fire support element function. The communication capabilities shall include communications with the higher headquarters. The TOC shall be provided with the appropriate tactical equipment, furniture and capabilities to create a realistic environment for the performance of battalion staff functions.

3.7.1.2.1 Combat engineering support.

The CES function shall provide command, control and maneuverability to emulated engineer vehicles. The engineer vehicles shall, when directed by the CES operator, displace by the following methods:

a. Follow a vehicle as described in 3.7.14.

b. Travel independently based on explicit directions from the CES workstation.

c. Travel independently based on predefined routes (i.e. Major Supply Routes).

The emulated vehicles shall be capable of providing the following (as enumerated in Table A-1):

a. Emplacement of minefields.

b. Emplacement of obstacles to include Log Cribs, Abatis, Concertina Fences, Tank Ditches, and Craters.

c. Breaching/Clearing of minefields (including marking the cleared minefield lanes).

d. Breaching/Clearing of obstacles to include Log Cribs, Abatis, Concertina Fences, Tank Ditches, and Craters.

e. Construction of Combined/Hull defilade positions,

f. Construction of infantry fighting positions.

g. Construction of terrain objects with the exception of ribbon bridges (ribbon bridges shall be constructed with no time delays upon command from the CES console operator).

h. Destruction of terrain objects to include ribbon bridges.

i. Deployment of the AVLB.

j. Recovery of the AVLB.

The CES console operator shall initiate, modify, and cancel any or all of the above functions. The CES initiated functions shall be accomplished in real-time and visually depicted in incremental stages on the exercise database. The CES console shall provide the operator an interactive graphical representation of the battlefield via a plan view display IAW 3.7.2.2.1.1. The console shall be located in the TOC tent extensions. The workstation shall include a field table-like work area/surface for the console, appropriate status boards, appropriate CCTT SINCGARS radio sets and an appropriate chair for a field environment. The CES functions shall simulate the vehicles specified in section 3.7.1. Dismounted Engineers shall be capable of performing engineering functions including mine clearing, mine laying and obstacle emplacement. Displayed engineering personnel assets shall be up to those assets organic or normally attached to a Heavy Battalion Task Force organization. The time to provide simulated engineering functions shall meet Army

Standards. Vehicles with attached engineering equipment shall exhibit limitations associated with the attached equipment to include increased weights, reduced speeds, nonavailability during attachment/removal, etc. Engineering functions shall be visually depicted in stages showing major accomplishments in the construction or destruction of provided capabilities. Along with these functions, the visual marking of minefields of a rectangular size with a selectable area of up to 5000 square meters shall occur in real-time through the use of icon placement and removal. The CES shall be capable of making twenty minefields for each exercise.

3.7.1.2.2 Fire support element.

The FSE shall provide simulated secure and non-secure radio communications with the FIST-V, the FABTOC, the FDC and the FO. The FSE station shall use CCTT SINCGARS radios, model AN/VRC-90/92 to provide the simulated radio communications. The FSE shall have the capability to coordinate fire support, including the implementation of the commander's guidance, establishing the priority given to targets, and development of the fire support plan. The FSE shall have the capability to monitor fires, including monitoring the delivery of fires and the capability of direct support fire units to provide fire support.

The FSE function shall provide the capability to enter, update, and display commander's guidance consisting of:

a. priority of fires

b. target priorities

c. priority targets

d. attack methods for mortars and artillery.

The FSE function shall provide the capability to create, modify, and display a fire support plan consisting of a fire support execution matrix, target list and data (including CAS targets and data), schedule of fires, fire support overlay elements, and control measures. The FSE function shall provide the capability to send and receive digital Free Text Messages and ”Message to Observer (MTO)” messages. The FSE function shall provide the capability to enter fire mission data, targets, and fire support asset status and location data. The FSE function shall provide the capability to initiate fire missions, send fire requests, intervene missions, and deny fire requests. The FSE function shall provide the capability to adjust fires. The FSE function shall provide the capability to plan and fire cratering missions.

The FSE function shall provide the capability to display fire support asset status and location data consisting of:

a. available fire support and assigned missions,

b. ammunition status,

c. allocation of priority targets,

d. fire support control measures,

e. fire support overlays.

The FSE function shall provide the capability to display fire fans for mortars and artillery. The FSE function shall allow selection of the following options from the simulated AFATDS MAIN menu bar:

a. Situations,

b. Alerts and Messages.

c. The FSE function shall allow selection of the following options from the simulated AFATDS CURRENT menu bar:

d. Mission Processing,

e. Targets,

f. Guidances,

g. Map.

The FSE function shall allow selection of the following options from the simulated AFATDS PLAN menu bar:

a. Planning,

b. Targets,

c. Guidances,

d. Map.

The FSE function shall provide the following Map controls:

a. create, display, and edit overlays,

b. scale/zoom,

c. show/hide labels and numbers,

d. display/hide map,

e. update unit locations.

The FSE function shall use the AFATDS windows and menus specified in Table I in an operable manner equivalent to the AFATDS FSE Fire Support Control Terminal windows and menus with option selections and functionality limited to that specified in the preceding FSE requirements. (Reference Document: Window Log for Advanced Field Artillery Tactical Data System (AFATDS) Operational Software, Version 1, 21 May 1993, Volumes 3,4,6; MX-25-212D.) The FSE simulation of AFATDS shall include a non-standard AFATDS mission type of cratering fire mission. The FSE function shall use menu bars and option selection pull-down menus equivalent to the AFATDS FSE Fire Support Control Terminal menus to traverse windows with menu option selections limited to the functionality specified in the preceding FSE requirements.

Table I. AFATDS Window IDs

Window Name	Window ID
Free Text Message	6805
Initiate Fire Mission	3005

Adjust	3739
Mission Monitor	3868
FS Intervention	3462
Active Mission List	3032
Message to Observer	3752
Mission Denied	3864
Fire Plan	3472
Schedule of Fires	3799
Target List	3477
Basic Target Info	3454
High Value Target List	4065
Mission Prioritization	4025
Mortar Attack Methods	4030
Field Artillery Attack Methods	4100
Field Artillery Support Matrix	4515
Fire Support Execution Matrix	4510
Check Firing	3744
Shift Window	3869
Polar Laser	3870
Quick Smoke	3861
Moving Target Information	3003
Main Menu	1000
Current Menu	1300
Plan Menu	1301

3.7.1.3 Unit Maintenance Collection Point (MANPRINT).

The UMCP shall provide the capability to coordinate repair and recovery of all battalion vehicle assets. The UMCP shall simulate repair vehicles and recovery vehicles. The dispatched repair and recovery vehicles shall automatically travel to the dispatched location utilizing the most tactically appropriate routes available unless otherwise directed by the UMCP operator. The UMCP vehicles shall, when directed by the UMCP operator, displace by the following methods:

a. Follow a HMMWV as described in 3.7.14.

b. Travel independently based on explicit directions from the UMCP workstation.

c. Travel independently based on predefined routes (i.e. Major Supply Routes).

The UMCP capability shall simulate the vehicles specified in section 3.7.1. The UMCP function shall allow the OC UMCP workstation operator to assign specific types of repair capabilities to each maintenance vehicle, limited only by the personnel capacity of each maintained vehicle. The repair capabilities assignable to maintenance vehicles by the OC UMCP workstation operator shall include Engine Repair, Transmission/Suspension Repair, Turret/Weapon Repair, Fuel System Repair and Communications/Electronic Repair.

The performance/limitations shall replicate the capabilities of the actual vehicles. The OC shall simulate recovery vehicles specified in section 3.7.1. The armored recovery vehicles and wreckers shall be visible in the CCTT database to retrieve vehicles back to the UMCP that are immobilized (stuck, damaged, etc.) in the terrain or non-repairable in the field. The dispatched vehicle shall service the requesting vehicle if it is within 200 meters of the repair vehicle. Once the dispatched vehicle is in range of the requesting combat vehicle, the UMCP shall receive a message at his console indicating arrival at the designated point. After a reasonable time for assessment (based on Army Standards) the UMCP shall receive a message which simulates the maintenance team's assessment of the problem. The message, received via the console versus the FM radio, shall state whether the team can repair the problem or not. If repairable, the repairs shall take place and shall match actual repair times associated with the task. If the repair is terminated for any reason, partial repairs shall be calculated based upon the time spent. If there is no vehicle at the designated request point, the UMCP operator shall receive a message at his console. If the requesting vehicle is not present at the designated request point, the operator shall be able to coordinate moving the dispatched vehicle to a new location for an additional requesting vehicle or to service other vehicles that are within 200 meters from the designated point. Once the desired repairs occur, the operator at the UMCP console shall either direct the repair vehicle to another vehicle or return back to the UMCP.

3.7.1.4 Fire Direction Center (MANPRINT).

Each of the two FDC stations shall be represented utilizing a mock-up of the M577A2 vehicle. The FDC station shall control the fires and compute the firing data for the mortar platoon or sections. The FDC station shall simulate the FDC to Gun Crew interface. The FDC station shall provide simulated radio communications with the FABTOC, the FIST-V, the FSE, and the FO. The FDC station shall provide simulated digital communications with the FIST-V, the FSE and the FO. The FDC station shall include the capability of entering computed firing data into the computer system and of entering actual firing data into the system that would normally be passed to the gun crews during fire missions. The mortar platoon's fire power shall be derated when damages or failures occur. The mortar platoon shall consist of two M577A2's and six M1064's with BMS 120. The mortar platoon shall be represented in the visual database as two sections. Each section shall consist of one M577A2 and three M1064's with BMS 120. Each section shall be capable of separate fire missions concurrently. The mortars shall fire at the maximum sustained rate during the first minute and at a sustained rate thereafter consistent with the capabilities of the actual weapon. The range of the mortars shall be consistent with the capabilities of the actual weapon. High explosive (HE), White phosphorus (smoke), and illumination rounds, as enumerated in table A-1, shall be simulated. The FDC station shall provide an ammunition on hand report, by ammunition type and quantity, upon request, subject to the restriction of reporting only the data available in a tactical situation. During initialization the mortar locations along with ammunition on hand shall be determined. The following missions shall be provided through the FDC:

a. Adjustments - a single round fired.

b. Firing for effect - all guns firing a specified number of rounds.

c. Final protective fires - a continuous curtain of fire stretching between two specified points.

d. Deliver field fires.

e. Move field fires.

f. Resupply field units.

The firing of mortars shall be displayed in the visual scene as respective flashes relative to their locations of the firing signature, associated flight times, and flashes/explosions at the points of detonation. Associated destruction shall occur and be displayed (e.g., bridge damage/destruction, vehicle damage, etc.). Firing shall be setup to be either pre-planned for a particular exercise and/or coordinated in real-time with requesting modules for immediate support in a location. The mortars shall not be capable of firing while in transit. The ballistic and damage probabilities for the various types of ammunitions fired by the mortars shall be simulated using Government firing and damage probability tables. The FDC station shall have the capability to move the FDCs about the visual database. The FDC station shall have the capability to report failures and damages, subject to the restriction of reporting only the data which would be available in a tactical situation.

3.7.1.5 Field Artillery Battalion Tactical Operation Center (MANPRINT).

The FABTOC shall provide direct support and general support level simulation of fire support and fire support coordination. The FABTOC shall contain a representation of the digital communications capability of the Advanced Field Artillery Tactical Data System (AFATDS) to provide simulated digital communications with the FIST-V, the FSE and the FO. The FABTOC station shall provide simulated radio communications with the FIST-V, the FSE and the FO. This communication capability shall allow the FIST-V to call for fire, adjust fire, register target reference points, develop pre-planned fires, provide intelligence, and conduct other free text communications. The FABTOC shall be depicted as two M577A2's in the exercise database. The FABTOC shall allow fire support personnel to accomplish the following:

a. Command and control of field artillery battalion direct support and general support operations,

b. Acquire targets through simulated digital message or radio communications with the

c. FIST-V, the FSE and the FO,

d. Deliver field artillery fires,

e. Move field artillery fires and units,

f. Resupply field artillery units,

g. Mass field artillery fires,

h. Variable Sheath Fires, and

i. Deliver cratering artillery fires.

The artillery available shall consist of three batteries of eight (8) howitzers and one battery of nine (9) Multiple Launch Rocket Systems (MLRS) of types specified in section 3.7.1. The howitzers shall be divided into platoons of four guns each. Each platoon shall be capable of firing its own unique mission or the same mission as the others. The howitzers shall fire at a maximum sustained rate of three rounds a minute for the first three minutes and one round per minute thereafter. The range of the howitzers shall be from 1000 to 30,000 meters utilizing a high explosive shell with two choices of fuze: point detonating or variable time set to a 20 meter height-of-burst. The MLRS shall be divided into platoons of three MLRS's each. Each platoon shall be divided into three sections. Each platoon or section shall be capable of firing its own unique mission or the same mission as other MLRS platoons. The MLRS shall have the capability to fire one rocket at a time or multiple rockets at a time up to a maximum of 12 rockets before reloading. Once all rockets are fired the MLRS shall not have the capability to fire again until the time required to reload the system has elapsed. The M270 MLRS shall have the capability to fire the M26 Tactical Rocket with the M77 basic warhead, and Terminal Guidance Warhead (TGW) as enumerated in Table A-1. The MLRS shall have the capability to fire missions on targets at ranges up to and including 30,000 meters. The simulation shall provide the capabilities of Area Denial Munitions (ADAM), Remote Anti-Armor Munitions (RAAMS), Copperhead, Anti-Personnel Improved Conventional Munitions (APICM), Dual Purpose Improved Conventional Munitions (DPICM), White Phosphorous (WP) smoke, High Explosive (HE) and Illumination rounds as enumerated in Table A-1. During initialization the vehicles and weapon systems locations along with ammunition on hand shall be determined. The effects of the firing shall be displayed in the visual scene as respective flashes relative to their locations of firing, associated flight times, and flashes/explosions at the points of detonation. Associated destruction of objects and models shall occur (e.g., bridge damage/destruction, vehicle damage/destruction, etc.). The ballistic and damage probabilities for the various ammunitions fired by the howitzers and M270 MLRSs shall be simulated using Government firing tables. The FABTOC console shall support standard field artillery missions including the use of either pre-planned or real-time calls for fires. Movement of the Field Artillery Battalion vehicles and weapons shall be controlled by the FABTOC console or by slaving to a manned simulator. The FABTOC weapons shall not be capable of firing on the move. The FABTOC console operator shall be able to select the following options for FABTOC vehicles: compute, stop, shoot a mission and then continue the movement.

3.7.1.6 Tactical air control party (MANPRINT).

The TACP station shall provide the capability to control close air support (CAS) missions. The TACP station shall provide a plan view display. The simulated aircraft shall be visible in the exercise database for the same conditions the aircraft would be visible in real world situations. The TACP simulation shall provide the capability for simulated aircraft evasive action for self protection. The system shall provide the capability to establish all CAS missions during initialization of an exercise. Initialization parameters shall include location, destination, weapons load, command instructions set attack profile (consisting of initial point, offset direction, and target type) and schedule. The TACP station shall provide the capability to divert any of the initialized CAS missions (provides on-call missions). The TACP simulation shall model air travel times from designated airfields to selected strike areas. The TACP station shall be located in the facility near the TOC. The TACP station shall be isolated from the TOC by a walled enclosure (not to the ceiling).

The TACP station will provide the following capabilities and displays to the TACP operator.

a. The TACP simulation shall include the aircraft specified in section 3.7.1.

b. The TACP simulation shall have the capacity for one (1) to five (5) pairs of aircraft per mission. The TACP simulation shall have the capacity to fly missions until either 50 missions have been flown or 100 aircraft have been used.

c. The TACP station shall provide the capability to prioritize targets. The TACP station shall provide the capability to control mission locations. The TACP station shall provide the capability to enter target descriptions. The TACP simulation shall provide messages (on the TACP console display) representing simulated radio communications from the aircraft.

d. The TACP station shall contain a single color monitor (19 inch minimum size) IAW Appendix A for the visual display.

e. Not used.

f. The TACP station shall contain a CCTT SINCGARS radio (which is part of the overall count of 36 OC radios) to support CAS requests.

g. Not used.

h. Not used.

i. Not used.

j. The MCC and the UOSP shall provide the capability to select ordnance loads for the TACP controlled aircraft. The CCTT system shall simulate ordnance weapons effects and damage caused by the ordnance used. The CCTT system shall simulate aircraft ordnance damage effects using Government damage probability tables. The MCC and the UOSP shall allow selection of the following munitions (as enumerated in Table A-1):

(1) Guns: GAU-8 Avenger, and GPU-5A.

(2) General purpose bombs. The general purpose bombs shall include the MK-82 500 pounds, MK-84 2000 pounds, and the BLU-109 2000 pounds. For general purpose bombs, the following fin configurations shall be simulated: low drag, high drag, and Air Inflated Retard. For general purpose bombs with low drag fins, the following timed delay fuze options shall be simulated: instantaneous, .1 second, and .25 second. For general purpose bombs with high drag fins, the following fuze options shall be simulated: proximity fuze and instantaneous timed delay. For general purpose bombs with Air Inflated Retard, the following fuze options shall be simulated: proximity fuze and instantaneous timed delay.

(3) Cluster bomb units. The following cluster bomb units, kits and attachments shall be simulated: CBU 52, CBU 58, CBU 71, CBU 87, and CBU 89.

(4) Laser guided Bombs. The simulation shall include the Laser Guidance Kits for the MK 82 or the MK 84 general purpose bombs.

(5) Anti-armor weapons. The following anti-armor weapons shall be simulated: the AGM-65 Maverick.

(6) Concrete penetration bomb. The following concrete penetration bomb shall be simulated: DURANDAL (BLU-107/B) , a 440 pound rocket-boosted bomb.

k. The CCTT system shall allow the operator to designate the close air mission as a cratering mission.

3.7.1.7 Higher headquarters workstation.

The higher headquarters workstation shall provide communications to the TOC. Command, control and support functions shall be provided by simulating the Brigade Command/Operations Net function, the Brigade Intelligence Net function and the Brigade Administrative/Logistics Net function. This workstation shall provide facilities for a higher headquarters person to simulate real world support for the TOC. The workstation shall consist of a four walled, open ceiling enclosure. The workstation shall include a work area/surface with appropriate status boards, three CCTT SINCGARS radio sets (which are part of the 36 overall OC radios), and an adjustable height, swivel chair with padded armrests and seat.

3.7.2 Control consoles.

The CCTT system shall be controlled by the Master Control Console and CCTT exercises shall be recorded and played back by the After Action Review Console.

3.7.2.1 Master Control Console (MCC) (MANPRINT).

The MCC shall be capable of performing the MC functions in the case of MC failure. The MCC console functions shall be accomplished through the use of a menu-driven user control system. The MCC shall have radio communication link with the rest of the CCTT system, selectable to a single module, a group of modules or entire site. The MCC shall have a plan view display capability. The MCC PVD shall provide a static presentation of the exercise situation upon operator selection. The MCC PVD shall not provide continuous updates of simulated entity positions. The MCC PVD shall provide snapshots of BLUFOR simulated entities as a default, and snapshots of OPFOR simulated entities as an operator selection. The MCC shall meet the C2 security level requirements of DOD-STD-5200.28. Malfunctions at the module level shall result in alert messages displayed at the MCC.

3.7.2.1.1 Start-up procedures.

The MCC console shall provide the capability to initialize the CCTT system over the network through the use of menus. The following capabilities and information shall be provided to the MCC operator on the overall system relative to powering-up, initialization, or monitoring a training session:

a. Not used.

b. Running the Daily Readiness Check.

c. Status of the CCTT FDDI network (number of users, traffic, saturation etc).

d. Status of all consoles/workstations in the OC.

e. Status of all manned modules on the network required for the selected training exercise(s) (i.e. exercise number, crew ID, operational status).

f. Selection of a training exercise identifying all required support (modules, extra inputs, etc.)

g. The manned modules and consoles/workstations shall be configurable to one of the five simultaneous exercises. The modules shall be reassignable and accommodate a failed initialization.

h. CCTT shall provide the software program to permit training units to prepare initial conditions on a personal computer utilizing Microsoft Windows 95 at their home station and then provide this information to the MCC operator on 3.5 inch floppy disc for exercise initialization.

i. Not used.

j. When a manned module or console/workstation finishes successfully the required power-up procedures, including Daily Readiness Check on the individual manned module or console/workstation, a message shall be sent automatically to the MCC and maintenance console indicating the particular manned module or console/workstation is up and ready for the planned exercise. If a module or workstation fails initialization, this information shall also be displayed and a menu list will identify equivalent unassigned modules, consoles or workstations.

k. Not used.

l. Physical location on the network shall not be a limiting factor, all modules required in a particular session shall be allowed to be anywhere (physically) on the LAN. The MCC shall have the capability to identify individual modules on the LAN via the network. The modules shall display the Army standard vehicle marking system identifier in the visual database. The crew ID shall be a 7-character alphanumeric code used to identify unit and vehicle.

m. Not used.

n. The fixed site MCC shall be able to initialize fixed site equipment and mobile CCTT equipment connected to the CCTT fixed site network. For new equipment installed permanently or temporarily at a fixed site, the fixed site MCC shall be able to initialize equipment connected to the CCTT fixed site network.

3.7.2.1.2 Exercise control.

The MCC shall provide to the operator the capability to develop, change, and select all aspects of the desired training exercise (e.g., weather conditions, time of day, friendly/enemy mix, fuel and ammunition loads, location of ammunition pre-stock in the database, logistical allocations, support allocations, vehicle locations and orientations, vehicle status in terms of age or condition). The MCC shall be able to control from one up to and including five exercises independently.

3.7.2.1.2.1 Exercise initialization.

The capability for the MCC operator to initialize a tactical exercise, on the terrain database as required by the training unit commander, shall be provided. Defaults for all parameters shall exist with the option to change any and all values. The capability to initialize modules as friendly or enemy in the visual database shall be provided. The capability to emplace individual vehicles, squads, platoons, company teams, and supporting units at specific coordinates with given orientation shall be provided. The MCC operator shall have the capability to emplace vehicles in standard deployment formations at a halt, i.e., company laager, combat trains laager, tail gate resupply, platoon herringbone, etc. The MCC shall place from zero (0) up to and including five (5) each fuel and ammunition prestock entities simultaneously on the battlefield per battalion TOC. Exercise initialization parameters shall be saved in data files and transportable on 3.5 inch floppy disc. During initialization of the exercises, the MCC shall assign up to, and including, fifty frequencies total for all exercises for radio communications. During the training exercise, the MCC shall have the capability to assign ten frequencies, plus the remaining frequencies unused from exercise initialization. The MCC operator shall be able to enter exercise date, initialization parameters and other salient characteristics at the start of an exercise.

3.7.2.1.2.2 Exercise modification.

Existing exercise initial conditions on file shall be capable of being permanently modified, or copied and modified to create new conditions through the MCC. The options for changing exercise parameters shall be the same as allowed for initial condition generation.

3.7.2.1.2.3 Exercise real-time intervention.

The MCC shall provide the ability to monitor and change any and all parameters of an exercise during its execution in a real-time mode. The effects of all changes shall be immediate and permanent only in the real-time operation. The stored data file for the particular initial conditions of an exercise shall not be affected by changes during an exercise.

a. Restart - The MCC operator shall have the capability to restart (without being powered-down) a single module up to a platoon of modules within an exercise using the initial conditions, within less than 30 seconds. For a group of modules greater than a platoon (to include the entire site) initialization shall take less than 5 minutes (without being powered-down).

b. Reconstitution - The MCC operator shall have the capability to reconstitute a module or group of modules. Reconstitution shall be defined as the reappearance of the vehicle or dismounted infantry once it has been killed. The module shall be placed in the same position with the same conditions (damage, fuel, ammunition, etc) just prior to being killed.

c. Pause/resume - The MCC operator shall have the capability to pause an exercise during real time and then resume without loss of information or insertion of anomalies.

d. Reset - The MCC operator shall be able to stop an exercise, select the desired time, reset parameters and values to the levels that existed at the nearest data storage time preceding the selected time, and to continue the exercise. The MCC shall provide the capability during initial condition to select the interval for recording checkpoint data. All simulated and non-fixed wing aircraft emulated moving entities when reset shall have zero velocity.

3.7.2.1.3 Current status.

At all times, the MCC shall provide data relative to the individual status (operational, non-operational, faults identified if any) of all equipment used in the current CCTT configuration to include all equipment indicated in 3.7.2.1.1n.

3.7.2.1.4 MCC console printer.

The MCC and MC stations shall be able to share printers over the network.

3.7.2.2 After Action Review (AAR) console (MANPRINT).

The AAR console shall have a plan view display, visual display, menu display, handset and speaker per radio, and a means to control the console functions.

For each CCTT system the capability to display from one up to and including five simultaneous exercises as described in paragraph 3.2.1 at five separate AAR consoles shall be provided.

The capability, without loss of fidelity, to display any AAR visual display channel or the AAR PVD upon a 68 inch by 92 inch front or rear color projection screen with a gain of one shall be provided.

3.7.2.2.1 AAR visual capabilities.

The AAR shall have a plan view, a visual display, and a menu display.

3.7.2.2.1.1 Plan view display.

The AAR plan view display shall consist of a color monitor (19 inch minimum size) with minimum of 1280 by 1024 addressable pixels, minimum of 8 color bits per pixel, and 4/3 aspect ratio. The AAR plan view display (PVD) shall display an orthogonal, topographical view of the gaming area. The AAR PVD shall operate from information available on the simulation network. The AAR PVD shall update at a minimum of 1 Hz. when displaying no more than 50 icons. Fire, detonation, and fast moving aircraft shall update to the AAR PVD display within 133 milliseconds of receipt of new data from the CCTT LAN. The AAR plan view display shall have a zoom capability in two modes. Each AAR PVD zoomed area shall fill the entire display. AAR PVD zoom mode one shall consist of a fixed window size that can be moved about the entire display to designate an area to be enlarged. The time period for AAR PVD zoom mode one to redraw with contour lines displayed shall not exceed five seconds. AAR PVD zoom mode two shall consist of a user selectable window size that will designate an area for enlargement. The time period for AAR PVD zoom mode two to redraw with contour lines displayed shall not exceed 15 seconds. The AAR PVD shall have the capability to create, edit, store, recall and display tactical overlays. The AAR operator shall have the capability to display tactical overlays on the AAR PVD. The AAR console shall display a portion of a tactical overlay if the current zoom mode does not allow display of the full tactical overlay. The AAR operator shall have the capability to display tactical overlays in any one or all of the colors, red, blue, and black. The AAR PVD tactical overlays shall be part of the displayed image. The AAR PVD tactical overlays shall move and zoom in conjunction with the underlying background, but are maintained as graphics whose components do not thicken or shrink with zoom, (e.g., in response to a zoom, an unfilled box symbol would increase/decrease in width and height while the thickness of its side would remain unchanged). The AAR console shall make use of methods that provide fast data entry for PVD tactical overlays such as drawing with a mouse, graphics tablet or a light pen; or selecting choices from windows, pull-down menus, dialog boxes, or icons. Entries and edits to AAR PVD tactical overlays shall be possible at any time prior to, during, or after (during playback of) the simulation. The AAR console operator shall at any time be able to store and recall AAR PVD tactical overlays.

a. The AAR PVD shall display icons representing all vehicle and dismounted infantry identities and their absolute condition (operating or destroyed), exclusive of position and cover.

b. The AAR PVD shall display terrain contour lines based on a 10 meter contour interval, switchable on and off.

c. The AAR PVD shall display natural and man-made terrain features. This shall include, but not be limited to, roads, forest areas, building, bridges, mine fields, rivers, etc. Applicable features shall show their absolute condition (e.g., if bridges are crossable or uncrossable, buildings are standing or destroyed, mine fields are breached or etc.). The AAR PVD shall also display individual terrain features, such as trees, at appropriate zoom levels which provides the operator an indication of partial visibility.

d. The AAR PVD shall display weapon trajectories - path, source, destination.

e. The AAR PVD shall display tactical overlays (versus overlays used by SAF), switchable on and off.

f. The AAR console shall allow the operator to selectively choose the area presented (full or partial gaming area) on the AAR PVD.

g. The AAR console shall allow the operator to selectively display (on or off) a shaded representation (color-coded for terrain type, similar to an Army 1:50000 map) of the topography of the land.

h. The AAR operator shall be able to print the tactical overlays.

3.7.2.2.1.2 Visual display.

The AAR console shall have a visual display which meets the requirements of appendix A. The AAR visual display shall provide a view of the visual environment.

3.7.2.2.1.3 Menu display.

The AAR menu display shall be a color monitor (19 inch minimum size) with minimum of 1280x1024 pixel resolution. The menus used to control the functions of the AAR console shall be displayed on the AAR menu display.

3.7.2.2.2 Real-time AAR.

The ability to accomplish the requirements stated in 3.7.2.2 and 3.7.2.2.7 of this specification shall also be provided to the AAR operator during the real-time operation of the training exercise. Updates to the displayed information shall occur as they are actually happening in the training exercise.

3.7.2.2.3 Operator control.

The AAR operator shall control the movement of the eyepoint through the data base by one or more control devices. The AAR eyepoint control device(s) shall provide control over the pitch, roll, yaw, vertical, lateral, and horizontal movement through the visual database. The AAR operator shall have the capability to alter the display or select a different display in either real-time or non-real-time environments.

a. Line-of-sight modes - The AAR operator shall have the capability of operating in three line-of-sight modes, which are the slaved mode, the independent mode, and the tether mode. The system shall not allow the AAR eyepoint to drop below the terrain surface. If the eyepoint moves more than 1 km during a LOS mode switch, the visual display update shall occur as limited by the hardware capabilities. If the eyepoint moves less than 1 km, the visual display update shall not exceed two seconds.

   (1) Slaved LOS mode - When operating in the slaved LOS mode the AAR operator shall be able to select and display the line-of-sight for either the gunner or commander’s crew position within any manned module. When in the slaved LOS mode, the visual display shall identify which vehicle and crew position is being displayed. The AAR operator shall be capable of displaying eyepoint with the magnifications available to the particular crew member for each vehicle.

   (2) Independent LOS mode - The AAR operator shall have the capability to position the AAR eyepoint anywhere in the gaming area from ground level up to and including an altitude of 300 meters. The AAR operator shall also have the capability to lock any combination of the AAR eyepoint parameters to the current state. Default settings for AAR eyepoint parameters shall be provided. The AAR eyepoint shall be capable of three power and ten power magnification.

   (3) Tether LOS mode - The AAR operator shall have the capability to tether (direction and velocity) the eyepoint to any vehicle in the visual database. When the AAR eyepoint is in tether mode, the same AAR eyepoint parameter controls shall be provided as for the independent mode. A capability shall be provided to lock the AAR eyepoint to the hull orientation of the tethered vehicle, when operating in tethered LOS mode.

b. Normal, thermal and light intensifier scenes shall be selectable by the AAR operator.

c. Display exercise information similar to that provided to the MCC such as module configuration, module status (operational), casualty status, ammunition and fuel status on the AAR menu display. MCC-type exercise information shall be at the single module level up to the company level on AAR menu display. MCC-type exercise information for enemy status shall also be provided on AAR menu display.

d. MCC-type exercise information displays shall be active during realtime recording and also during playback, on AAR menu display.

e. The AAR visual display shall provide a simulated compass reading indicating the AAR eyepoint orientation in the visual database.

f. The AAR operator shall have the capability to adjust the sensitivity of the AAR eyepoint control device(s).

3.7.2.2.4 After Action Review (AAR).

The AAR console shall have the capability to store all network data and communications traffic. The AAR operator shall be able to replay a complete selected training exercise for after action review. After record mode is selected by the AAR operator, the training exercise from that point on shall be recorded (both audio and visual) with coded time marks for every minute.

a. When in replay mode, the replayed data on the AAR visual display shall be identical to the same data that would have been displayed if the real-time AAR display option was selected.

b. The AAR operator shall have the capability to selectively choose any replay start time within the recorded exercise. The actual replay start time shall be within plus or minus one minute of the requested start time.

c. Not used.

d. The AAR operator shall have the capability to play back at a selectively variable speed up to 5:1 faster than real-time.

e. Not used.

f. The AAR console shall be capable of recording and storing complete exercises, regardless of length, without loss of data. Sufficient storage space shall be provided to store the magnetic media containing two months worth of recorded exercise training data. It is estimated that an average exercise will not exceed eight hours. The data stored, by the AAR console, shall be capable of long term off-line storage. The data stored, by the AAR console, shall contain exercise identification information, including date. AAR shall display exercise identification information on the AAR menu display when media is loaded.

g. The AAR operator shall have the capability to advance the playback to the next time-stamped message on the voice annotation channel.

h. The AAR console shall show graphically estimated time remaining on data storage media.

3.7.2.2.5 AAR console printer.

AAR shall be able to share printers over the network. The AAR printer shall not employ electrostatic or thermal print mechanisms requiring special paper.

3.7.2.2.6 Data collection.

Automatic data collection, reduction and analysis shall be a selective option capability provided to the AAR console. Once selected, the data collection, reduction and analysis shall cover all modules and stations in the CCTT system providing data from individual modules to platoon and company size groups for a given exercise.

The data collected by AAR shall be provided from stored record files in raw data format. The data collected by AAR shall be provided in a statistical format relating the individual performances (i.e. individual modules, platoon, or company) and group performance as selected by the operator. The statistical reports shall be displayed or printed by the AAR printer as requested by the AAR operator for individual module, platoon, or company levels through the use of menus.

a. The statistical reports shall include Killer-victim scoreboard (equipment and personnel)

(1) Friendly force on enemy force

(2) Enemy force on friendly force.

b. The statistical reports shall include Field-of-View (FOV) report

(1) Who was in the FOV of whom

(2) When did this occur

(3) What were the coordinates of each party.

c. The statistical reports shall include Direct fire report

(1) Who fired when

(2) Who fired at whom

(3) What weapon/ammunition was used

(1) What were the results

(2) How many weapons platforms did not engage enemy targets.

d. The statistical reports shall include Indirect fire report

(1) Number of missions

(2) Rounds fired

(3) Percent effective

(4) Percent ineffective

(5) Unit requesting.

e. The statistical reports shall include What weapon killed what target with what type of ammunition.

f. The statistical reports shall include What was the ammunition expenditure

(1) What was the amount of each type of ammunition expended

(2) Who expended what ammunition.

g. The statistical reports shall include Mine field report (results)

(1) Number of minefields

(2) Number of mines per minefield

(3) Number of friendly vehicles passing through the minefield

(4) Number of friendly vehicles killed

(5) Number of enemy vehicles passing through the minefield

(6) Number of enemy vehicles killed.

h. The statistical reports shall include TACP (results).

i. The statistical reports shall include a DAMAGE report which contains the information:

(1) Who had failures

(2) What were the failures

(3) When did the failures occur

(4) Where did the failures occur

(5) What was the cause of the failures (stochastic, deterministic, etc.).

j. The statistical reports shall include What were the personnel casualties.

k. The statistical reports shall include What was the loss exchange ratio (enemy loss/friendly loss).

l. The statistical reports shall include What was the force exchange ratio (enemy loss/total enemy force)/(friendly loss/total friendly force).

During the exercise statistical data reports reflecting current or accumulated exercise data shall be available on the AAR console upon AAR operator request.

3.7.2.2.7 AAR communications.

The AAR console shall record all radio communication traffic for the selected exercise. The recorded communications shall be played back in time sequence with the visual during after action review. The AAR console shall provide at least four CCTT SINCGARS radios with speakers, with the capability to select the radio frequency and volume for each.

3.7.2.2.8 Additional AAR capabilities.

During replay, the AAR operator shall be able to select the voice annotation channel as one of the four channels routed to loudspeakers. The AAR console shall allow the AAR operator to make time-stamped verbal annotations, during real-time exercise only.

The AAR console shall allow the AAR operator to make textual annotations. The AAR console, at the AAR operator request, shall display or print a list of all textual annotations. The AAR console shall allow input, update, display and print of text. The AAR operator will use this capability for review of unit training objectives/ARTEP/MTL.

The AAR shall record the visual displayed on the large screen display as well as at least one of the four voice channels (including the verbal annotations) to a VHS video tape. This video tape will be part of the take home package.

The AAR shall generate and display the intervisibility region around an object on the AAR PVD. The AAR shall combine intervisibility regions to show coverage area on the AAR PVD.

The AAR shall toggle between the last 2 PVD displays in less than 85ms.

AAR shall record exercise data at any recording-capable AAR console should the local AAR data logging device be unable to record.

An AAR shall record only one exercise at a time.

The AAR operator shall be provided a voice instruction channel to allow communication to a single module/workstation , a group of modules/workstations, or all modules/workstations participating in the exercise that AAR is assigned. The AAR operator shall be able to communicate on any active radio channel assigned to the same exercise as the AAR station.

CCTT shall support a synchronized mode for at most 2 groups of AAR consoles. In synchronized mode, there shall be one controlling AAR console and one to four slaved AAR consoles. The slaved AAR consoles shall replicate the PVD and visual displays of the controlling AAR console. The controlling and slaved AAR consoles shall be restricted to adjacent rooms.

3.7.2.3 Maintenance console (MANPRINT).

The system shall have a maintenance console (MC) separate from the MCC. The maintenance console shall consist of equipment which shall communicate with and have the capability to control the CCTT network and the system. The MC shall provide controls and displays for Performance Monitoring, including monitoring the network, IAW 3.2.9.2.1.2, Fault Localization IAW 3.2.9.2.1.3 and Daily Readiness Check IAW 3.2.9.2.1.1. The full use of the maintenance console shall not require more than one person. The MC shall not require mounting of storage media during start up, trainer operation, and shut down. The maintenance console shall provide a graphical status of the module conditions using various colors. The display shall identify those modules which are operational, their exercise number, pending failures, ongoing PM/FL, and PM/FL status using various colors. The maintenance console shall be capable of performing each and every MCC function independently or simultaneously with the MCC, excluding the network manager. The maintenance console shall be capable of downloading new CCTT software versions and terrain databases to the modules and other workstations via the CCTT network. The MC shall meet the C2 security level requirements of DOD STD-5200.28. From system startup, the MC shall record the time at power-up for each module, console and workstation, the time at exercise initialization, and the time an exercise ended. The MC shall provide the capability to display and print the recorded time described above for each module.

3.7.3 Trainer system processing resource.

The CCTT system processing resource shall consist of all computer system hardware and system software. The CCTT system processing resource shall meet all functional, operational simulation, control, processing, and design requirements of this specification. As a minimum, there shall be one group of CCTT system processing resources to perform the consoles/workstations functions and another group of CCTT system processing resources for each manned module. The requirements of sections 3.7.3 through 3.7.3.3.3 shall not apply to the image generator.

3.7.3.1 Computer system hardware.

All computer system hardware shall consist of COTS processing systems (including microcomputers, single board computers, minicomputers, super minicomputers, supercomputers, Central Processing Units (CPU), Internal Processing Units (IPU), Auxiliary Processing Units (APU), or special processing units such as array processors). In addition, all of the following items shall be COTS: peripherals, controllers, cables, and interface (I/O equipment which is used to interface to computer peripherals, networks, or TUE I/O devices).

3.7.3.1.1 System composition.

The hardware architecture shall maximize the use of a common family of processors and provide a common set of system interfaces and peripherals in common configurations.

3.7.3.1.2 Processor requirements.

The system displays and indications shall have minimal discernible stepping, oscillating, or jittering. Solution and iteration rates, and the algorithms employed shall provide mathematically consistent and stable solutions to the dynamics equations. The system dynamic response requirements of this specification shall be utilized to develop the iteration rate structure and processor input/output design. Sufficient installed memory shall be provided for each processor so that the computer system can store and execute the complete trainer operational program and still meet the spare requirements stated in this specification. Communication between individual processors and between other portions of the system shall be provided with the speed and channel capacity to meet trainer performance specified herein.

3.7.3.1.3 Not Used.

3.7.3.1.4 Peripherals.

The minimum set of peripherals described below shall be provided and installed as part of the computer system. Additionally, the equipment and associated software shall be provided to allow the installation of updates to all software (for both contractor developed and commercial software).

a. Disk systems and controllers shall consist of one or more hard disk units or optical storage units or other equivalent high reliability equipment (MTBF 30,000 hours or greater). The total installed disk capacity shall be sufficient to store all required program software including object and database for developmental and non-develop software, other required machine readable deliverables, and provide required spare capacity.

b. Tape unit(s). Magnetic tape unit(s) shall be provided, installed, and connected to allow verified backup and restore of data from all disk system unit(s). Magnetic tape units shall be allowed to be externally connected from the processors or remotely connected via system LAN in order to satisfy this requirement. The magnetic tape unit(s) shall have read and write capability and shall be capable of backing up, onto magnetic tape media unit (reel, cartridge, cassette, etc.), the data stored on processor disk units. The backup shall be accomplished at an average transfer rate of 50k bytes/second or greater. The tape unit shall also be capable of restoring, including verification, the same amount of data back to the same or an identical disk unit at an average transfer rate of 50k bytes/second or greater. The tape unit shall have the capability to write and read in accordance with a recognized and approved formal industry or other formal organizational standard (e.g. ANSI, IEEE, International Standards Organization (ISO)) so that tapes written/read by the provided tape unit can be read/written with no errors by a different manufacturer's COTS tape unit.

c. The fixed site shall have five network printers, four color-capable printers and one black-and-white printer. Each Mobile OC Trailer shall have two network printers, one color-capable printers and one black-and-white printer. The color-capable printers shall have capabilities equivalent to or better than the following specifications:

Laser or ink-jet technology

600 x 300 dpi resolution in text mode

6 ppm output speed in text (black-only) mode

300 x 300 dpi resolution in full color mode

5 - 1 ppm output speed in full color mode

Post Script Capability

Minimum Duty Cycle of 8000 pages per month

Minimum 2 MB Memory with expansion capability

Maximum Desktop footprint of 20” wide x 18” deep Maximum Height of 18”

The black-and-white printers shall have capabilities equivalent to or better than the following specifications:

Laser technology

600 x 600 dpi resolution

12 ppm output speed

Post Script Capability

Duty Cycle of 35,000 pages per month

Minimum 2MB Memory with expansion capability

347.1 mm (13.06”) maximum print line in landscape mode

203.2 mm (8”) maximum print line in portrait mode

Maximum Desktop footprint of 18” wide x 24” deep Maximum Height of 24”

Electrostatic or thermal print mechanisms requiring special paper shall not be acceptable.

3.7.3.1.5 Spare requirements.

Spare resources for each processor shall be provided as defined below, to allow for expansion and modification.

a. Spare memory. Spare memory for each processor equal to at least 30 percent of the installed memory for that processor shall be provided. Spare memory for any shared memory (or other memory configuration such as reflective memory) equal to at least 30 percent of the installed shared (or reflective) memory shall also be provided. Expansion capabilities to 50 percent spare memory shall be provided for both processor and shared memory with the only requirement being the addition of memory, without any other hardware changes. All installed spare memory shall be addressable by the delivered processor and operating system.

b. Spare disk. Spare disk storage shall be provided for each disk media unit (magnetic, optical, or other equivalent technology) equal to at least 25 percent of the available installed, formatted storage on that disk media unit. Spare disk capacity shall be provided equal to at least 50 percent by allowing additional disk storage to be populated in the processor.

c. Spare processing time available in any contiguous 1-second period of time on all host processors shall be greater than or equal to 50% (25% for CGF) on average, including periodic and aperiodic processes. Spare processing time shall be verified under worst case trainer operating conditions, as defined below, while 30 percent of the processor's memory is unused (spare). Worst case trainer operating conditions shall occur when the trainer is supporting an 851 entity Battalion level single exercise. The Battalion level single exercise scenario to be used shall be agreed to by STRICOM and the contractor.

d. The spare I/O channel capacity for each type of I/O channel shall be equal to 20 percent of the total installed I/O channel capacity. Spare input/output capacity. I/O channels shall be defined to include all analog-to-digital, discrete interface devices, and all serial and parallel computer interfacef ports excluding channels used to interface to the computer's peripherals and to the main simulator network. Exceptions: In lieu of installed spare I/O channel capacity, spare I/O card slots shall be provided to accommodate I/O channel expandability.

e. Not used.

f. The bandwidth used on the CCTT system LAN and interfaces shall not exceed more than 60% of the maximum usable bandwidth while processing a total of 1700 entities. Maximum useable bandwidth shall be determined by empirical test data.

3.7.3.2 Trainer system software.

CCTT system software shall consist of developmental software and nondevelopmental software.

3.7.3.2.1 Software development requirements.

Software shall be developed in accordance with DOD-STD-2167 and the Statement of Work. Software shall be programmed in accordance with the statement of work (SOW).

3.7.3.2.1.1 Coding standards.

The Software design and coding standards shall include the following:

a. Comments. Comments shall be in plain English. Comments shall describe the software functions performed by the System Software.

b. Names. Names, as described in MIL-STD-1815, section 4.1, shall make use of underscore and Ada's large character limit. Abbreviated names or portion of names shall not be used except in cases where the only appropriate name exceeds 20 characters and where a meaningful abbreviation can be substituted.

c. Strong typing. Ada strong typing shall be used. Overloading shall be permitted where ambiguity does not result.

d. GOTO statements. GOTO statements shall not be used.

e. Style of Presentation. Source code listings shall be processed by the TSSE Pretty Printer Tool. Each line shall contain at most one statement.

f. USE Statements. USE statements shall only be used as specified in the approved design and coding standards.

g. Prologue section. A standard prologue for Ada source code shall be provided with every Ada compilation unit.

h. PRAGMA Statements. PRAGMA SUPPRESS statements shall not be used.

i. Machine Dependent Code. Machine dependent code and compiler dependent code shall be logically grouped into separate Ada packages.

3.7.3.2.2 Software components.

The CCTT system software shall consist of the following components:

a. Application Software. The application software provided shall consist of:

(1) The software required to perform the simulation and instructional functions of the CCTT System.

(2) The software required to control the CCTT System.

(3) The software required to monitor the performance of the CCTT System including spare processing time and time utilized for each program unit.

(4) The software required to test or demonstrate compliance of the CCTT System.

b. Operating system/run time environment. The operating system or other run time environment software provided shall be COTS software.

c. Diagnostic Software. The diagnostic software provided shall be COTS software provided to, or available for purchase by, any commercial purchaser of the hardware provided. Additional developmental software needed to control the diagnostic software shall be provided. The diagnostic software shall include the software for the Daily Readiness Check, Performance Monitoring and Fault Localization IAW 3.2.9.2.1.The Trainer System Software shall contain no unique software for the Mobile configurations.

3.7.3.2.3 Computer Software Configuration Items (CSCIs).

The Trainer System Software (TSS) shall be provided in the following CSCIs:

a. Unmodified Government-Furnished Trainer Operational Software CSCIs. Each distinct Government-Furnished program shall maintain its existing CSCI identification where possible or be designated as a CSCI. Government-Furnished Trainer Operational Software, which is modified in any way, shall be considered developed software and treated as part of the trainer operational software (3.7.3.2.3 sub d.).

b. COTS Software CSCIs. These CSCIs shall consist of COTS software used in the trainer. Each commercial software product shall be a separate CSCI.

c. Reusable Software CSCIs. Each distinct reusable program shall maintain its existing CSCI identification where possible or be designated a new CSCI.

d. Trainer Operational CSCI(s). This CSCI(s) shall consist of all developed application software.

e. Trainer Support CSCI(s). This CSCI(s) shall consist of any developed support software which do not fall into categories above but are needed to provide support over the life cycle of the Trainer System including developed software and utilities needed to meet or test the performance and maintainability requirements of this specification.

3.7.3.3 Trainer System Support Environment (TSSE).

The TSSE shall provide a stand-alone system independent of the trainer computational systems for software development and maintenance of the Trainer System. The TSSE shall meet the C2 security level requirements of DOD-STD-5200.28. The TSSE shall consist of 3 interrelated systems

a. Ada Program Support Environment (APSE) including Computer Aided Software

b. Engineering (CASE) tools and hardware resources

c. Sound Cue Generation System including hardware and software resources software resources.

The requirements will be verified as part of the Post Deployment Support System (PDSS) selloff for CLIN 0130AG.

3.7.3.3.1 TSSE hardware.

The TSSE hardware shall consists of a COTS equipment to support the 3 interrelated systems.

a. APSE Hardware. The APSE hardware shall provide the computational resources necessary for the execution of the APSE software.

(1) System units and a central file server shall provide the computational resources necessary for the execution of the APSE software specified in paragraph 3.7.3.3.2. The system units shall be selected so that the operation response time described in item (4) below are met. A minimum of six workstations shall provide a capability for six support personnel to simultaneously perform software development. Each user shall have the capability to work on any portion of the TSS except the Sound Cue Generation system and the Visual Database Generation system.

(2) Digital magnetic tape unit(s) shall be compatible with that of the Trainer System.

(3) Disk unit(s) shall provide secondary storage of the APSE software and the developed trainer software. Disk unit(s) shall have sufficient capacity to store the entire APSE software including all trainer system software, and not utilize more than 50 percent of the storage capacity.

(4) APSE response time for operator actions shall not exceed Table XXIX of MIL-STD-1472D with a full processing load (i.e. compiles, binds or tests executing on all processors). The completion time required for compiles, binds, and tests under a full processing load shall not increase by more than 35% over the time the same operation would take with no other operations being performed on the APSE.

(5) A printer shall provide a capability of operating at a speed of at least 600 lines per minute, in upper and lower case alpha. The printer shall have a capability of printing up to 132 characters per line with the 96 character set, 10 characters per inch on plain

paper or plain computer paper. Electrostatic or thermal print mechanisms requiring special paper shall not be acceptable.

b. Sound Cue Generation System. The Sound Cue Generation System Hardware shall provide the resources required to digitize and edit sound cues.

(1) A minimum of one workstation shall provide the capability to digitize and edit sound cues.

(2) A digital magnetic media shall be compatible with that of the Trainer System.

c. Visual Database Generation System Hardware. The Visual Database Generation ystem Hardware shall provide the resources required to generate visual databases.

(1) A minimum of one workstation shall provide the capability to generate visual databases.

(2) Additional hardware shall be provided to support the functional requirements of paragraph 30.7.3 of Appendix A.

(3) Digital magnetic media shall be compatible with that of the trainer system.

d. A chair shall be provided for each TSSE workstation. This chair shall be upholstered in cloth, padded (armrest, seat, and back), have armrests and be provided with adjustable height and backrest, full swivel base, and swivel casters.

e. A work surface (table/desk) shall be provided to support the CRT, keyboard, and various peripherals at each workstation. The work surface shall have a hard and smooth surface. The work surface shall meet the requirements of paragraphs 5.7.3.1 through 5.7.3.3 of Mil-STD-1472D.

3.7.3.3.2 TSSE software.

The TSSE software shall provide for life cycle support of the trainer system software and data files. TSSE software shall include both developmental and non-developmental software. APSE software shall be non-developmental COTS software products to the maximum extent possible. Any developmental TSSE software shall be developed in accordance with the same software development requirements as the Trainer System Software.

The TSSE software shall provide as a minimum the following integrated APSE and CASE tools and utilities:

a. A validated Ada compiler (or cross-compiler) and Ada Run Time Environment (ARTE) or operating system shall be provided. The compiler shall be validated for the specific system target configuration. All necessary PRAGMAS and Ada LRM Chapter 13 features needed to perform the software development shall be implemented in the provided compiler(s). The ARTE or operating system shall provide all run time environment functions needed for life cycle support and include the ARTE(s) and/or operating system(s) as used in the trainer system.

b. A linker-loader shall be provided.

c. An Ada language sensitive editor with syntax checking capability shall be provided.

d. A COTS Ada Programming Design Language (PDL) or Ada Design Language (ADL) shall be provided.

e. An Automated Configuration Management Tool (ACMT) shall be provided. The ACMT shall include an unmodified COTS System. The ACMT shall have the following capabilities:

(1) The ACMT shall track changes to any machine readable information such as source code, object code, and documentation.

(2) The ACMT shall track all configurations items by unique identifiers.

(3) The ACMT shall produce deliverable data in ASCII format.

(4) The ACMT shall track dependencies between all combinations of source code, object code, processors, and technical documentation.

(5) The ACMT shall maintain complete change history including archiving and retrieval of original baseline and all subsequent versions. The ACMT shall save only deltas for each new version.

(6) The ACMT shall reconstruct previous configuration baselines on demand.

(7) The ACMT shall track and control serial or parallel change activities.

(8) The ACMT shall document/annotate/track all changes to all configuration items (for example, delivered source instruction, processors, and documentation paragraph identification) at all levels.

(9) The ACMT shall track multiple trainer software configurations and multiple adaptation of each of the trainers.

(10) The ACMT shall ensure integrity of different levels of authority, functions, and access via password protection and access control.

(11) The ACMT shall provide automated audit reports.

(12) The ACMT shall be menu driven.

(13) The ACMT shall track status (ie. change assignment, development, test, accept/reject, hold and deassignment).

(14) The ACMT shall track released configurations through development, test and approval.

(15) The ACMT shall create new working configurations from previously approved configurations.

f. An Ada source-level interactive symbolic debugger shall be provided.

g. An Ada library management tool shall be provided.

h. A Pretty printer tool shall be provided for uniform source code formatting.

i. The software tools to support and transition across each of the software development phases shall be provided.

j. A compilation order (”MAKE”) tool shall be provided.

k. A program execution profiler (time analysis) tool shall be provided.

l. The compilers, translators, or assemblers for any other approved languages used in the Trainer System shall be provided.

m. The software required to create and modify sound cues shall be provided.

n. The software required to create and modify visual and correlated terrain databases shall be provided.

3.7.3.3.3 TSSE firmware support.

Where firmware is supplied as part of the trainer development or as reusable software, the contractor shall provide a firmware support system.

3.7.4 Network system.

The CCTT network system shall cover the utilization of the CCTT system Local Area Network (LAN) for the fixed, mobile, and Quickstart sites and the eventual connection of a Long Haul Network (LHN) to any of these type sites. (Note LHN is a P^3I item). The CCTT system LAN shall be composed of the following COTS hardware and software.

a. The CCTT system LAN hardware shall consist of the interface adapters, network concentrators, and interconnecting cables.

b. The CCTT LAN Software shall consist of the communications protocol profile software and the network manger software.

3.7.4.1 Local Area Network Capabilities.

The system LAN used in CCTT shall be provided with the following capabilities:

a. The CCTT system network and required interfaces shall be able to support a minimum of 1700 entities per fixed site battalion TOC including communications operating concurrently in real-time. (Note: An entity is a manned or emulated vehicle, aircraft, weapon and dismounted infantry).

b. A minimum of 100 of the 1700 entity count shall be manned modules (M1A1, M2A2/M3A etc.) with the remainder being emulated.

c. The capability to operate with an entity count of 1700 shall be provided without saturation of the CCTT system LAN.

d. The execution of an exercise or multiple exercises totalling a combined count of 851 entities shall not result in any restrictions to real time training or cause abnormal visual effects or delays.

e. The network shall have a long-haul expansion capability without requiring any hardware modifications to the simulators or the network.

f. The CCTT system LAN shall be able to support a module being removed or added to the network during training without affecting the remaining modules on the CCTT system LAN.

g. A module or workstation processor which becomes incapable of accepting operator, or network inputs (i.e. 'hung') shall not affect the operation of the network

h. The network shall be able to span an overall length of two kilometers between adjacent nodes.

i. The CCTT network system shall provide data transfer for both voice simulation data and digital communications data.

j. The network interface adapter shall provide the capability to selectively control the generation of host processor interrupts.

k. The network system shall be easily expandable subject only to the limitation imposed by the ANSI FDDI standard of 1000 physical connections.

l. The CCTT system LAN shall have the capability to interconnect multiple CCTT mobile configurations with each other and with colocated fixed site CCTT systems. The composite of these interconnections shall constitute the CCTT system LAN for the purposes of this specification.

3.7.4.2 LAN communication protocol.

The CCTT communication protocol profile shall be compliant with the International Standards Organization (ISO) Open Systems Interconnect (OSI) 7-layer architecture model as follows:

a. The CCTT application level protocol and message format shall conform to I.E.E.E. 1278 or to the latest draft 'Standard for Distributed Interactive Simulation - Application Protocols' approved by the DIS Steering Committee.

b. The Transport and Network layer functions and services shall be provided by UDP/IP.

c. The Data Link Layer functions and services shall be provided by the I.E.E.E. 802.2 Logical Link Control protocol, which provides for interoperability among LANs and by the FDDI Media Access Control Protocol.

d. The Physical layer shall use the ANSI X3T9 Fiber Distributed Data Interface (FDDI) Physical Layer Medium Dependent, FDDI Physical Layer Protocol, FDDI Token-Ring Media Access Control, and FDDI Station Management standards.

e. The CCTT communications protocol profile shall provide multicast services to the CCTT applications.

3.7.4.3 Network Manager.

A network manager function shall be provided for the CCTT system LAN. The network manager shall measure the performance of the network elements, analyze the state of the network, and log significant network events to support post-exercise analysis of network activity. The network manager function shall provide a graphical interface for reporting maintenance and performance information to the operator. The network manager function shall provide a graphical depiction of the on-line status of all network nodes. The network manager function shall allow an operator to monitor and graph packet, bandwidth, and error rates on the CCTT system LAN. The network manager function shall allow network interface performance thresholds to be set at nodes on the CCTT system LAN. The network manager function shall cause an operator alert to be generated when a threshold is exceeded. The network manager function shall reside in the Maintenance Console. The network manager function shall use the Simple Network Management Protocol to facilitate the management of CCTT network elements at each node on the CCTT system LAN.

3.7.4.4 Physical Connectivity LAN.

The CCTT system LAN shall be configured as a dual ring of one or more FDDI concentrators. The CCTT FDDI concentrators shall be interconnected by dual multi-mode fiber optic cables. All CCTT modules and workstations shall be connected to the FDDI concentrators by multi-mode fiber optic cables. All fiber optic cables shall use standard MIC connectors to interface to the concentrator and to the RISC processor FDDI LAN interface adapters. All modules or workstations which occur once in a CCTT system shall be connected to two different concentrators when more than one concentrator is present. All modules or workstations which occur multiple times in a CCTT system shall be connected to one concentrator.

3.7.4.5 Network Reliability.

The reliability of the network concentrator shall exceed 0.999 for an 8-hour exercise.

3.7.5 Visual system.

The CCTT visual requirements are stated in appendix A, Close Combat Tactical Trainer Visual System.

3.7.6 Communication system.

The CCTT communications system shall provide two-way communication which simulate radio, FED, AFATDS, and intercom communications. The communications, except intercom, shall be accomplished via digital data packets on the local area networks. This capability shall be able to support the one to five separate exercises that may occur as identified in 3.2.1. The CCTT communications shall provide a total of sixty simultaneous communication channels for each CCTT system. The communication systems shall meet a 60 dB signal-to-noise ratio and a 60 dB crosstalk requirement.

3.7.6.1 Radio Communication System.

Radio communication shall provide module-to-module, module to OC, module to blue SAF units, OC to higher headquarters and, OC to blue SAF units communication during real-time exercise operation. It will also provide RXMT communications when required. Communications shall only be possible when speaking on the same frequency or hopset, and shall be limited in the sense that a message can only be heard when in the listening position. During multiple transmissions on the same hopset (frequency hopping mode), a receiver shall receive the signal which arrives first at the receiver’s location with adequate signal strength to be recognized and treat other signals as interfering signals. During multiple transmissions on the same frequency (single channel mode), a receiver shall receive the signal with the highest signal strength at the receiver’s location or, if the signal strengths are the same, the transmission initiated first.

The ability to communicate and the quality of transmission (noise and signal level) shall be affected by distance, terrain, and interference in the exercise gaming area. The quality of transmission shall be determined at each receiver’s location relative to the transmitter location based upon the terrain database. The quality of transmission shall be based on a Frequency Modulation (FM) propagation model such as the Terrain Integrated Rough Earth Model (TIREM) developed by the Electromagnetic Compatibility Analysis Center (ECAC). Exercise gaming scenarios that present high degradation or interruption of the transmission signal by obstacles or terrain elevation shall be handled by the RXMT communications. The frequency and channel selection shall be provided at each position where external communication occurs in the operational vehicle and OC. The effects of CRYPTO and frequency hopping mosaics shall be simulated to include cryptographic related aural tones.

3.7.6.2 SINCGARS Radios.

The CCTT radio communication system shall replicate the appearance, control, and operation of the SINCGARS radios. The seven SINCGARS models shall be replicated to include 87, 88, 89, 90, 91, 92, and PRC119. Each and every M1A1, M1A2, and M2A2/M3A2 module shall have two SINCGARS radio receiver-transmitters. These radios shall be individually activated during initialization to simulate a command vehicle. In scenarios requiring RXMT communications, only the radio pair within the module can be used.

The SINCGARS radio simulation shall provide the following minimum capabilities:

a. Communication among exercise participants as specified in paragraph 3.7.6.1,
b. Frequency selection with and without preset channels,
c. Volume control,
d. The M1A2 simulator shall communicate real-time battlefield data via the Inter-Vehicular Information System (IVIS) with other M1A2s.
e. Deleted
f. RXMT

3.7.6.3 Manned Module Communication System.

A communication system shall be provided to each manned module providing radio and intercom communications capabilities to the crew positions defined in table II (Specific crew position communication requirements for the DI module are addressed in Section 3.7.10.5).

The capabilities shall include an intercom system for use within the manned module (with the exception of the DI module) and a CCTT SINCGARS radio system for use in the CCTT system to communicate with the Operations Center (OC) and other desired units as described in 3.7.6.1. This shall be accomplished utilizing the Intercommunication Unit Controls (IUC). Each crew compartment shall be provided with a speaker which allows for the monitoring of radio communications. The speaker shall be provided with a volume control.

Table II. Manned Module Intercommunication Unit Control Allocation

Module	Driver	Commander	Gunner	Loader	Targeting	Commu ni-cation	Obser-ver	Troop Com-partment
M113APC	X	X						
M1A1	X	X	X	X				
M2A2/ M3A2	X	X	X					X (3)

M1A2	**X**	**X**	**X**	**X**				
M981 FIST-V	**X**				**X**	**X**	**X**	
HMMWV	**X ***						**X ***	

*Note: The communication system provided for the HMMWV simulation system shall provide a CCTT SINCGARS radio capability.

3.7.6.3.1 Intercommunication Unit Control.

The intercom and radio control box at each crew member position shall be comprised of the following equipment:

a. Monitor switch.
b. Volume control.
c. Interconnecting jack for operation with the CVC helmet (squad headset in M2A2/M3A2 Troop Compartment).
d. Transmit/Intercom switch as found at each crew position of the actual vehicle.
    (1) Tank Commander's and Loader's stations (M1A1 and M1A2)

3.7.6.4 Precision Lightweight GPS Receiver (PLGR)

The CCTT PLGR units shall replicate the appearance, control, and operation of the real-world units. The CCTT PLGR units shall provide the following minimum capabilities:

a. Backlit display for use in substandard lighting conditions
b. Capable of performing area navigation functions and storing up to 999 waypoints
c. Capable of storing up to 15 routes with up to 25 legs per route
d. Fully functional keypad

Data entry procedures shall emulate those used with the real world PLGR. On-Line help displays shall be provided. Warning displays associated with the provided functions shall be fully supported. Power up and power down of the simulation PLGR shall be the same procedures used with a real-world PLGR.

The following major functional areas shall be provided:

a. Menu Selection Displays.
The Menu Selection Displays shall provide the following capabilities:
(1) Status Displays:
Display pages shall be provided that give detailed information on navigation ability, satellite data, power source, antenna source, battery data, self-test data, and interface activity.
(2) PLGR Setup:
Selection pages shall be provided that allow the PLGR to be customized. The following

configuration pages shall be provided: operating mode setup, coordinate system and unit type setup, magnetic variation selection, display customization, automatic-off time control, data port configuration, automark control, operator ID setup, and waypoint approach setup.

(3) PLGR Initialization:
Display pages shall be provided that allow specific PLGR data to be initialized. The following pages shall be provided: position initialization, time and date initialization, and track and ground speed initialization

(4) Commanded Self-Test:
The user-directed self-test function and all associated displays shall be provided.

(5) On-Line Help Displays:
On-Line Help display pages shall be provided.

(6) Navigation Alerts Setup:
Selection and display pages shall be provided that allow navigation alerts to be setup and displayed when specific conditions exist.

(7) Custom Navigation Setup:
Selection and display pages that allow the PLGR's navigation displays to be customized shall be provided.

(8) Remote Targeting:
Selection and display pages that allow the PLGR to acquire data from a target using a Laser Range Finder shall be provided.

b. Waypoint Selection Displays.
The Waypoint Selection Displays shall provide the ability to perform the following actions:
(1) Enter waypoints
(2) Edit waypoints
(3) Copy waypoints
(4) Calculate a waypoint from given data
(5) Calculate the distance between two given waypoints
(6) Clear a range of waypoints
(7) Define a mission route. This function shall provide selection and display pages that allow a new route to be entered, an existing route to be edited, routes to be copied, routes to be cleared, and the distance of a route to be calculated.

c. Position Selection Displays.
The Position Selection Displays shall provide the following capabilities:

(1) Present Position Display:
A display page shall be provided that gives detailed information on the operating mode, position coordinates and error, elevation, and elevation reference.

(2) Time, Date, Track, and Ground Speed Display:
A display page shall be provided that displays the time, time error, date, track, and ground speed.

(3) Satellite Summary Display:
A display page shall be provided that displays data relative to the satellites being tracked. The following data shall be provided: satellite vehicle identifiers for satellites being tracked and searched, the number of visible satellites, the number of healthy satellites, and the age of the almanac data received from the satellites.

(4) Datum, Magnetic Variation, and Operator ID Display:
A display page shall be provided that displays the current datum, magnetic variation, and the operator ID.

(5) Bullseye Display:
A display page shall be provided that displays the range and azimuth from a common reference point to the present position.

d. Navigation Selection Displays.
The Navigation Selection Displays shall allow the PLGR to be used to locate the present position relative to other waypoints. Selection pages shall be provided to allow selection of the navigation mode and method. Display pages shall be provided to display navigational data.

e. Mark Selection Displays.
The Mark Selection Displays shall provide the ability to perform the following actions:
(1) Mark the current position as a waypoint
(2) Mark the current position as a Man Overboard waypoint

3.7.7 SAF.

All requirements for SAF are contained in Appendix F.

3.7.8 M1 family of vehicles simulator modules.

All requirements for the M1A1 simulator module are contained in Appendix H. All requirements for the M1A2 simulator module are contained in Appendix J.

3.7.9 M2A2/M3A2 Bradley Fighting Vehicle (BFV) simulator module.

All requirements for the M2A2./M3A2 simulator module are contained in Appendix I.

3.7.10 DI module.

The DI module shall operate in two modes - the dismounted infantry mode and the dismounted scout mode. In the dismounted infantry mode, the DI module shall consist of a platoon leader and forward observer position and two squad leader positions. In the dismounted scout mode, the DI module shall consist of a platoon leader position and two scout section leader positions. The DI module shall operate on the CCTT terrain database.

3.7.10.1 Physical characteristics (MANPRINT).

The DI module shall consist of three compartments. One of the compartments will be the infantry platoon leader and forward observer position (also used by the scout platoon leader). The other two compartments will be infantry squad leader positions (also used by the scout section leaders). The three DI module compartments shall share the same enclosure. The three DI module compartments shall operate isolated from each other.

This section contains the minimum physical requirements for the individual positions within the DI module.

3.7.10.1.1 Platoon leader and FO position.

The platoon leader and forward observer position shall provide the simulation requirements for both the platoon leader and forward observer. The forward observer position visual scene shall be controlled (on/off) at the platoon leader position. The platoon leader position shall provide a 180 degree horizontal by 30 degree vertical field of view when the forward observer position's visual scene is off. The platoon leader position shall provide a 108 degree horizontal by 30 degree vertical field of view when the forward observer position's visual scene is on. The foward observer position shall provide a 36 degree horizontal by 30 degree vertical field of view when on. The platoon leader and forward observer position visual shall each be able to slew 360 degrees to the right or to the left from any point. The platoon leader and forward observer position visual shall each be able to slew in pitch 90 degrees up from the zero degree line of sight of the current position (standing, kneeling, or prone). The platoon leader and forward observer position visual shall each be able to slew in pitch 45 degrees down from the zero degree line of sight of the current position (standing, kneeling, or prone). The platoon leader and forward observer position default pitch for the visual scene shall be the zero degree line of sight from the standing, kneeling, or prone position. Visual anomalies related to visual priority and visual database paging shall be allowed for platoon leader and forward observer when the forward observer is active.

The platoon leader position shall provide a minimum of six square feet of work surface and one chair. The forward observer position shall provide one chair. The chairs for the platoon leader and forward observer position shall be upholstered in cloth. The chairs for the platoon leader and forward observer position shall be padded. The chairs for the platoon leader and forward observer position shall have armrests. The chairs for the platoon leader and forward observer position shall have adjustable height. The chairs for the platoon leader and forward observer position shall have adjustable backrest. The chairs for the platoon leader and forward observer position shall have a swivel base. The chairs for the platoon leader and forward observer position shall have swivel casters.

The DI module controls for the platoon leader and forward observer position shall meet applicable location and design requirements from MIL-STD-1472. The DI module indicators for the platoon leader and forward observer position shall meet applicable location and design requirements from MIL-STD-1472.

3.7.10.1.2 Squad leader's position.

The squad leader position shall provide the simulation requirements for the squad leader. The squad leader position shall provide a visual with a 180 degree horizontal by 30 degree vertical field of view. The squad leader position visual shall be able to slew 360 degrees to the right or to the left from any point. The squad leader position visual shall be able to slew in pitch 90 degrees up from the zero degree line of sight of the current position (standing, kneeling, or prone). The squad leader position visual shall be able to slew in pitch 45 degrees down from the zero degree line of sight of the current position (standing, kneeling, or prone). The squad leader position default pitch for the visual scene shall be the zero degree line of sight from the standing, kneeling, or prone position. The squad leader position shall provide a minimum of six square feet of work surface and one chair. The chair for the squad leader position shall be upholstered in cloth. The chair for the squad leader position shall be padded. The chair for the squad leader position shall have armrests. The chair for the squad leader position shall have adjustable height. The chair for the squad leader position shall have adjustable backrest. The chair for the squad leader position shall have a swivel base. The chair for the squad leader position shall have swivel casters.

The DI module controls for the squad leader position shall meet applicable location and design requirements from MIL-STD-1472. The DI module indicators for the squad leader position shall meet applicable location and design requirements from MIL-STD-1472.

3.7.10.2 Performance characteristics.

The DI module shall provide the capability to fire at targets with a probability of hit based on distance to the target. The DI module shall provide the capability to identify targets as friend or foe from reasonable ranges. The DI module shall provide soldier movement capabilities taking into account terrain, load, and fatigue effects. The DI module shall replicate real world delays associated with ammunition transfers.

The following paragraphs contain the minimum performance requirements for the dismounted infantry module system.

3.7.10.2.1 Weapons.

The platoon leader and forward observer position and the squad leader positions shall have the capability to employ and engage the M16A2 Rifle. The platoon leader and the squad leader positions shall have the capability to employ and engage the M249 Squad Automatic Weapon (SAW). The platoon leader and the squad leader positions shall have the capability to employ and engage the M47 Dragon. The platoon leader and the squad leader positions shall have the capability to employ and engage the AT4 Antitank Weapon. The platoon leader and the squad leader positions shall have the capability to employ and engage the M203 Grenade Launcher. The platoon leader and the squad leader positions shall have the capability to employ and engage the M60 Machine Gun. The platoon leader and the squad leader positions shall have the capability to employ and engage the Anti-Armor Weapon System-Medium (AAWS-M) (Javelin).

The platoon leader and squad leader positions shall have the capability to select the rate of fire for the M16A2 Rifle. The platoon leader and squad leader positions shall have the capability to select the rate of fire for the M249 Squad Automatic Weapon (SAW). The platoon leader and squad leader positions shall have the capability to select the rate of fire for the M60 Machine Gun.

The DI module shall provide the capability to replenish ammunition, personnel, and weapons resources from an infantry, scout, or supply vehicle. The DI module shall simulate muzzle velocity, maximum effective range, sustained rate of fire, rapid rate of fire, and cyclic rate of fire for the M16A2 Rifle. The DI module shall simulate muzzle velocity, maximum range, sustained rate of fire, rapid rate of fire, and cyclic rate of fire for the M249 Squad Automatic Weapon (SAW). The DI module shall simulate muzzle velocity, minimum range, and maximum range for the M47 Dragon. The DI module shall simulate muzzle velocity, minimum range, and maximum range for the AT4 Antitank Weapon. The DI module shall simulate muzzle velocity and maximum range for the M203 Grenade Launcher. The DI module shall simulate muzzle velocity, maximum range, sustained rate of fire, rapid rate of fire, and cyclic rate of fire for the M60 Machine Gun. The DI module shall simulate muzzle velocity, minimum range, and maximum range for the Anti-Armor Weapon System-Medium (AAWS-M) (Javelin).

The DI module shall simulate the visual effects of impacting rounds for the M16A2 Rifle. The DI module shall simulate the visual effects of impacting rounds for the M249 Squad Automatic

Weapon (SAW). The DI module shall simulate the visual effects of impacting rounds for the M47 Dragon. The DI module shall simulate the visual effects of impacting rounds for the AT4 Antitank Weapon. The DI module shall simulate the visual effects of impacting rounds for the M203 Grenade Launcher. The DI module shall simulate the visual effects of impacting rounds for the M60 Machine Gun. The DI module shall simulate the visual effects of impacting rounds for the Anti-Armor Weapon System-Medium (AAWS-M) (Javelin).

The DI module shall simulate a visual muzzle flash for the M16A2 Rifle, M249 Squad Automatic Weapon (SAW), and M60 Machine Gun. The DI module shall simulate a visual launch signature for the M47 Dragon, AT4 Antitank Weapon, and the Anti-Armor Weapon System-Medium (AAWS-M) (Javelin).

3.7.10.2.2 Movement.

The platoon leader position shall provide a digital direction indicator (simulated compass) for sighting targets and navigating on the terrain database. The forward observer position shall provide a digital direction indicator (simulated compass) for sighting targets and navigating on the terrain database. The digital direction indicator (simulated compass) for the platoon leader's position shall provide the compass reading for the platoon leader's current view direction (the center of the center visual monitor). The digital direction indicator (simulated compass) for the forward observer's position shall provide the compass reading for the forward observer's current view direction (the center of the forward observer's visual scene). The platoon leader's visual shall provide a compass azimuth sighting wire located in the center of his visual scene. The forward observer's visual shall provide a compass azimuth sighting wire located in the center of his visual scene.

The squad leader position shall provide a digital direction indicator (simulated compass) for navigation on the terrain database. The digital direction indicator (simulated compass) for the squad leader position shall provide the compass reading for the squad leader's current view direction (the center of the center visual monitor). The squad leader position visual shall provide a compass azimuth sighting wire located in the center of the center monitor.

The DI module shall provide the capability to crawl across the terrain in any direction at an appropriate speed. The DI module shall provide the capability to walk across the terrain in any direction at an appropriate speed. The DI module shall provide the capability to run across the terrain in any direction at an appropriate speed. The squad leader shall have the capability to select either fireteam.

The DI module shall provide the leader the capability to select an individual soldier using the visual scene. The squad leader shall have the capability to control the weapons of either fireteam. When the squad leader positions are unmanned, the platoon leader shall have the capability to select either squad. When the squad leader positions are unmanned, the platoon leader shall have the capability to control the weapons of either squad.

Each of the DI module positions shall provide a plan view display showing the units controlled by the position and their orientation, when identified by the leader, with respect to the terrain. The DI module plan view display shall provide the leader the capability to direct his unit elements movements. In the dismounted infantry mode, the squad leader can direct his two fireteams and the platoon leader can direct his two unmanned squads by invoking semi-automatic controls. In the dismounted scout mode, the section leader can direct his individual scout members and the platoon leader can direct his two unmanned sections by invoking semi-automatic controls. The DI module shall provide the leader the capability to direct his unit element movements using the visual scene. The squad leader shall have the capability to move each of his fireteams independently. The squad leader shall have the capability to select the fireteam movement formation (wedge or file). The squad leader shall have the capability to select the squad movement formation (line, column, or file). When the squad leader positions are unmanned, the platoon leader shall have the capability to select the platoon movement formation (line or column). When the squad leader positions are unmanned, the platoon leader shall have the capability to move each of his squads independently. When the squad leader positions are unmanned, the platoon leader shall have the capability to select the squad movement formation (line or column).

The platoon leader and forward observer positions shall provide the capability to view the terrain with line of sight conditions from the standing, kneeling, or prone position. The squad leader position shall provide the capability to view the terrain with line of sight conditions from the standing, kneeling, or prone position. The squad leader position shall provide the capability to view the terrain from either of his two fireteam eyepoints. When the squad leader positions are unmanned, the platoon leader and forward observer position shall provide the capability to view the terrain from each of the platoon's fireteam eyepoints. The DI module shall provide reports of enemy sightings to the leader from his subordinate units. The platoon leader and forward observer positions and the squad leader positions shall provide the capability for eye/head movement independent of body movement.

The platoon leader, forward observer, and squad leaders shall be able to visually identify their own vehicle on the terrain database through the use of the vehicle marking system. The mounted soldiers shall be capable of identifying their own dismount elements within a distance of 100 meters. The DI module shall provide the capability to engage dismounted enemy. The DI module shall provide the capability to engage enemy armor. The DI module shall provide the capability to engage enemy aircraft. The DI module shall provide the capability to disengage dismounted enemy. The DI module shall provide the capability to disengage enemy armor. The DI module shall provide the capability to disengage enemy aircraft.

The DI module shall provide the capability to mount an M2A2/M3A2 BFV. The DI module shall provide the capability to mount an M113A3 APC. The DI module shall provide the capability to mount a troop-carrying rotary wing aircraft. The DI module shall provide the capability to dismount right or left from an M2A2/M3A2 BFV, as selected by the leader. The DI module shall provide the capability to dismount right or left from an M113A3 APC, as selected by the leader. The DI module shall provide the capability to dismount right or left from a troop-carrying rotary wing aircraft, as selected by the leader.

The DI module shall provide the capability to perform squad-level reorganization. Reorganization consists of re-establishing command and control, re-manning key (M60, M249, M203, Anti-Armor Weapon System-Medium (Javelin), M47 Dragon) weapons, and redistributing ammunition. The DI module shall provide the capability to perform platoon-level reorganization. Reorganization consists of re-establishing command and control, re-manning key (M60, M249, M203, Anti-Armor Weapon System-Medium (Javelin), M47 Dragon) weapons, and redistributing ammunition. The DI module shall provide the capability to perform squad-level consolidation. The DI module shall provide the capability to perform platoon-level consolidation.

The DI module shall provide the capability to employ fire support. The DI module shall provide the capability to cross fordable water obstacles. The DI module shall provide the capability to cross defile. The DI module shall provide the capability to move using bounding overwatch. The DI module shall provide the capability to react to an ambush. The DI module shall provide the capability to perform an ambush. The DI module shall provide the capability to defend against an air attack.

The DI module shall provide the capability to emplace mines. The DI module shall provide the leader the capability to direct the emplacement of M18A1 Claymore mines using the visual scene. The DI module shall provide the capability to emplace obstacles. The DI module shall provide the capability to mark minefields. The DI module shall provide the capability to breach a permanent or semi-permanent minefield and to clear a hasty minefield. The DI module shall provide the capability to breach obstacles. The DI module shall provide the leader the capability to direct his unit elements' mine and obstacle emplacement and breaching activities using the visual scene.

The DI module shall provide the capability to use 7 power binoculars. The DI module shall provide the capability to use image-intensifying night vision goggles.

The DI module shall provide the capability to perform an assault. The DI module shall provide the capability to react to enemy contact. The DI module shall provide the capability to break contact.

The DI module shall provide the leader the capability to assign sectors of fire using the visual scene.

3.7.10.2.3 Fire control system.

The DI module shall provide a Forward Entry Device (FED) digital message capability to the forward observer at the platoon leader and forward observer position. The DI module shall provide the capability to select a sector for unit fires. The DI module shall provide the capability to select point targets. The DI module shall provide the capability to select fields of fire for selected weapons.

3.7.10.2.4 Depletable resource management.

The DI module shall manage ammunition, personnel, and weapons as depletable resources. The DI module shall provide the capability to manage the resupply of ammunition, personnel, and weapons. The DI module shall provide status information reflecting the current weapon, ammunition, and personnel resource situation.

The DI module ammunition load shall be based on the transport capabilities of the squad, platoon, M2A2/M3A2 BFV, and M113A3 APC. The Dragon weapon resources shall be limited by the storage capacity of the M2A2/M3A2 BFV, the M113A3 APC and the trade-off with the TOW II missile. The DI module shall monitor the depletion of ammunition resources based on actual usage. The platoon leader position shall have the capability to perform battlefield resupply using a pre-stock. The squad leader position shall have the capability to perform battlefield resupply using a pre-stock. The platoon leader position shall have the capability to perform battlefield resupply using an appropriate vehicle. (Vehicle resupply will require prior coordination with the ALOC.) The squad leader position shall have the capability to perform battlefield resupply using an appropriate vehicle. (Vehicle resupply will require prior coordination with the ALOC.) The DI module shall allow a resupply operation to begin when the unit to be resupplied is within 200 meters of a pre-stock or appropriate vehicle.

The DI module shall monitor the use and resupply of ammunition based on the ammunition transfer time from soldier to weapon. The DI module shall monitor the use and resupply of ammunition based on the ammunition transfer time from an infantry, scout, or supply vehicle to a soldier. The DI module shall monitor the use and resupply of ammunition based on the ammunition transfer time from pre-stock to soldier.

The DI module shall provide the platoon leader the capability to reorganize squads. The DI module shall provide the platoon leader the capability to combine squads. The DI module shall provide the squad leader the capability to reorganize fireteams. The DI module shall provide the squad leader the capability to combine fireteams. The DI module shall notify both squad leaders when the platoon leader combines squads. The DI module shall allow squad-level reorganization when troop strength falls below 50 percent of the squad’s initial strength. The DI module shall allow platoon-level reorganization when troop strength falls below 50 percent of the platoon’s initial strength.

3.7.10.3 Controls and indicators .

This section contains the minimum requirements for controls and indicators provided to the individual positions within the DI module.

3.7.10.3.1 Platoon leader and FO position.

When the squad leader positions are unmanned, the DI module shall provide the platoon leader and forward observer position a squad status report for each of the platoon’s squads. The DI module shall provide troop strength, current location, current activity and ammunition as part of a squad status report.

3.7.10.3.2 Squad leader’s position.

The DI module shall provide the squad leader position a fireteam status report for each of the squad’s fireteams.

3.7.10.4 Visual displays.

The visual requirements are stated in appendix A, Close Combat Tactical Trainer Visual System. The DI module shall use the specific manning levels (from one soldier to platoon size numbers) set during initial condition setup for units controlled by the DI module positions. The DI module shall be capable of displaying individual soldiers and groups of soldiers in the standing, kneeling, or prone position. The DI module shall be capable of displaying soldiers armed with a rifle, an automatic rifle, or an anti-tank weapon. The DI module shall be capable of displaying individual soldiers and groups of soldiers whose individual movements follow the terrain. The DI module shall be capable of displaying the correct number of remaining combat ready soldiers as casualties and fatalities occur within units.

3.7.10.5 Communications system.

The communication system shall provide a CCTT SINCGARS radio communications capability to the DI module, as specified in 3.7.6. The squad leader position shall be provided with one simulated SINCGARS radio. The platoon leader position shall be provided with two simulated SINCGARS radios. The forward observer position shall be provided with one simulated SINCGARS radio. The communication system shall provide for normal communications between the platoon leader, squad leaders, M2A2/M3A2 BFV, and other modules. The communication system shall provide for normal communications between the platoon leader, the company headquarters, and the Operations Center.

3.7.10.5.1 Radio capabilities.

The DI module simulated SINCGARS radios shall provide frequency selection with preset channels. The DI module simulated SINCGARS radios shall provide frequency selection without preset channels. The DI module simulated SINCGARS radios shall provide volume control.

3.7.10.6 Sound generation system.

The DI module shall provide three independent, identical sound generation systems - one for each of the DI module’s three compartments. The DI module shall not provide an acoustic vibration generation system. The DI module sound generation system shall be separate from the communication system and the sounds shall be presented independently of any headphone system (i.e. multiple loudspeakers). The DI module sound generation system shall provide a realistic combat sound environment with realistic cues and distractions. Table III lists the sound cues that shall be provided in the DI simulation system. The DI module sound generation system shall provide sounds of sufficient volume to distract the operator, similar to actual combat, without violating the guidelines of MIL-STD-1474 or exceeding 81dB for steady state noise (measured at the ear).

Table III. DI Manned Module Sound Cues
EXTERNAL SOUND CUES
Wheeled vehicle, large class - engine noise based on velocity
Wheeled vehicle, small class - engine noise based on velocity
Tracked vehicle - engine noise based on velocity
Aircraft, rotary wing class - engine noise based on velocity
Aircraft, fixed wing class - engine noise based on velocity
Collision of objects - same as HMMWV sound cues adjusted for distance and objects colliding
BLUFOR M16A2/M249 firing - use M16A2 sound for both
OPFOR Small Arms firing - use AK-74 sound for all
Friendly/Hostile Medium Machine gun firing - use M60 Machine gun sound for all
Friendly/Hostile Heavy Machine gun firing - use .50 Caliber machine gun sound for all
Friendly/Hostile Grenade Launcher firing - use M203 sound for all

Table III. DI Manned Module Sound Cues
EXTERNAL SOUND CUES
Friendly/Hostile tank main gun firing - use M1A1 120mm sound for all
Friendly/Hostile automatic gun firing - use M2/M3 25mm sound for all
Friendly/Hostile mortar firing - use 120mm mortar sound for all
Friendly/Hostile missile/rocket launch
MLRS launch
Generic small explosion (grenades)
Generic large explosion (main gun, missile, rocket) hit
Generic large explosion (main gun, missile, rocket) miss
Generic kinetic round hit
Friendly/Hostile mine hit
Friendly/Hostile bomb hit
Friendly/Hostile bomb miss
Friendly/Hostile artillery hit
Friendly/Hostile artillery miss

3.7.10.6.1 Sound Synchronization.

The DI module sound generation system shall be synchronized with the visual displays within the system latency requirements (defined in paragraph 3.2.2.1). The DI module sound generation system shall be synchronized with the dismounted infantry controls within the module latency requirements (defined in paragraph 3.2.2.2).

3.7.10.6.2 Sound generator.

The DI module sound data shall be stored locally in the DI module sound system. The DI module shall be able to retrieve sound data and produce the corresponding aural cue within the manned module latency. The DI module shall be able to control the frequency of the sounds over a wide continuous range. The DI module sound generation system shall provide separate outputs for driving the subwoofer. The DI module sound generation system shall be capable of generating a minimum of eight sounds simultaneously with full parametric control of frequency and volume. The DI module sound generation system channels shall be ”shared” by several different sounds on a priority basis. The number of sound generation channels shall be expandable to allow for future needs that may require the capability to generate a larger number of sounds simultaneously.

3.7.10.6.3 Storage.

The DI module sound generation system shall be expandable to allow for future increases in storage to hold a larger set of sound data.

3.7.10.6.4 Spatial Positioning.

The DI module sound generation system shall provide four speakers for each of the three compartments. The DI module sound generation system shall provide for spatial positioning (direction and distance) of the sound cues. The spational positioning of sounds should be such that a leader operator may identify the direction and approximate distance of the event causing the sounds. The DI module sound generation system shall synchronize the sound cues with the actions causing the sounds. The time delay between the actions causing the sounds and the actual playing of the resulting aural cue will be directly related to the distance from the point of the sound's origination within the CCTT system. The intensity (loudness) of the sounds shall be directly related to the distance from the point of the sound's origination within the CCTT system.

3.7.10.6.5 Audio Amplifiers.

The audio amplifiers shall be of sufficient quality and power-handling capability to recreate the required volume levels without distortion greater than 0.05 percent Total Harmonic Distortion (THD) over the dynamic range.

3.7.10.6.6 Speakers.

The speakers shall be of sufficient construction and placement so that the necessary training environment sounds and effects are achieved. Headphones shall not be required to present the ambient ”sounds of battle.”

3.7.10.6.7 Sound quality.

The DI module sound generator shall provide a frequency range of 25 Hertz (Hz) +/-5 Hz to a minimum of 12,000 Hz. The DI module audio amplifiers shall provide a frequency range of 25 Hz +/-5 Hz to a minimum of 20,000 Hz. The DI module combined signal to noise ratio of the sound generator and audio amplifiers shall be a minimum of 70dB. The combination of speaker types shall provide a composite frequency response of 25 Hz to 20,000 Hz +/- 10 dB (after each speaker output has been independently referenced to 0 dB).

3.7.11 M981 Fire Support Team Vehicle (FIST-V) simulator module.

All requirements for the M981 FIST-V simulator module are contained in Appendix K.

3.7.12 Not Used.

3.7.13 M113A3 APC simulator module

All requirements for the M113A3 APC simulator module are contained in Appendix G.

3.7.14 HMMWV simulator module

All requirements for the HMMWV simulator module are contained in Appendix L.

3.8 Mobile CCTT requirements.

”Mobile Platoons” of M1A1 Tank, M2A2/M3A2 Bradley Fighting Vehicle (BFV), and Dismounted Infantry (DI) simulator modules shall be provided in semitrailers (multiple trailers per site as required) as specified herein. The Mobile CCTT configuration shall be functionally equivalent to and provide the same degree of reliability, supportability, and maintainability as the Fixed Site CCTT configuration. All requirements for the fixed site version shall apply to the mobile version unless specifically stated otherwise herein. Mobile CCTT shall derive all power for this configuration through the power system of 3.8.5. The Mobile CCTT configuration shall meet Department of Transportation (DoT) regulations for transportation without requiring special permits. The Mobile CCTT configuration shall meet the transportability requirements of ASTM-D-3951 and shall comply with all Federal Motor Vehicle Safety Standards.

3.8.1 Workstations.

The Mobile CCTT design shall provide the following collocated workstations within semitrailers:

a. The ALOC and UMCP stations shall be designed so that the two functional areas are operated by one individual.

b. The FDC, TACP, FSE, and FABTOC stations shall be designed so that the four functional areas are operated by one individual.

c. The CES station shall be designed so that it is operated by one individual.

d. The 2 SAF stations (blue force and red force) shall be designed so that they can be operated by one or two individuals.

e. Not used.

f. Each site shall provide a combined AAR and MCC station with seating for 16 persons. The AAR shall be represented as described in paragraph 3.7.2.2 without large screen.

3.8.2 Environmental conditions.

The Mobile CCTT configuration shall withstand the climatic environments of the continental United States. Mobile CCTT shall withstand the following environmental conditions without deformation, cracking, damage, and unusual wear of internal and external components.

3.8.2.1 Non-operational climatic environment.

During transit, site nonuse, and storage, the Mobile CCTT non NDI Category A and B equipment shall accept ambient temperatures within the following extremes with 0% to 95% relative humidity non-condensing:

a. Low extreme: Minus 46°C (-51°F) with no solar load.

b. High extreme: Plus 52°C (+125°F) plus a solar load of 1120 Watts per square meter (W/m^2) (355 $BTU/ft^2/hr$) on the semitrailer exterior skin.

The Mobile CCTT trailer structures and equipment mounted on the exterior of the structures will meet the above requirement. NDI Category A and B equipment, approved by the Goverment, shall accept ambient temperatures within the following extremes with 0% to 95% relative humidity non-condensing:

a. Low extreme: Minus 18 degrees C (0 degrees F) with no solar load.

b. High extreme: Plus 52 degrees C (+125 degrees F) plus a solar load of 1120 Watts per square meter (W/m2) (355 BTU/ft2/hr) on the semitrailer external skin.

These conditions shall not affect the semitrailer operation for transit.

3.8.2.2 Operational climatic environment.

Training shall take place, without degradation, within the Mobile CCTT semitrailers when outside ambient temperatures and humidity are within the following extremes:

a. Low temperature extreme: Minus 40oC (-40oF) with no solar load.

b. High temperature extreme: Plus 52oC (+125oF) plus a solar load of 1120 Watts per square meter (W/m2) (355 BTU/ft2/hr) on the semitrailer exterior skin. Plus 46oC (+115oF) for PPS maintenance room.

c. Relative Humidity: 0% to 95% noncondensing for temperatures below 80oF; and as characterized by a curve connecting the following data points extracted from MIL-STD-210C for temperatures in the range of +80oF to +125oF.

Temperature in ^{o}F	Relative Humidity
80	95%
86	90%
105	60%
125	03%

All components of the Mobile CCTT configuration shall be fully functional within this temperature range. Set-up and dismantling of Mobile CCTT for training shall not be affected within this temperature range.

3.8.2.3 Lightning protection.

The Mobile CCTT configuration shall be provided with lightning protection for all equipment components.

3.8.3 Shock and vibration.

The Mobile CCTT configuration shall withstand the road conditions specified herein. Mobile CCTT shall be designed such that it shall not be damaged, nor shall performance be degraded when it is subjected to the shock and vibrational stresses produced during transit and normal use. All equipment shall be mounted and secured in a manner that precludes damage and shifting during transit.

3.8.4 Semitrailers and Vans.

Each Mobile CCTT semitrailer shall be in accordance with the following requirements. Dimensions and tolerances shall be such that standard commercial parts shall be freely interchangeable. These semitrailers shall contain and transport all Mobile CCTT equipment components as specified herein.

3.8.4.1 Treatment, painting identification marking and data plates.

Unless otherwise specified herein, the treatment, painting, identification marking, data plates, and registration numbers shall be in accordance with MIL-STD-1223 and FED-STD-595 for U.S. Army. When bright aluminum panels are furnished, the exterior color of visible steel members on the semitrailer shall be the same color as the aluminum panels. Sections 5.1.3 and 5.1.4 of MIL-STD-1223 shall not apply.

3.8.4.2 Color.

The exterior shall be painted white in accordance with FED-STD-595. The specific color number (per FED-STD-595) will be specified by the Government.

3.8.4.3 Rustproofing.

The semitrailer shall be rustproofed in accordance with FED-STD-297. The rustproofing compound used shall be subject to authorization by the Government.

3.8.4.4 Hardwood.

Flooring and wooden parts used in the semitrailer construction shall be fabricated from the types of lumber listed in 3.2.1 of MIL-H-3912. Wood shall not be used as a structural component of the semitrailer.

3.8.4.5 Wood treatment.

Wood surfaces shall be treated in accordance with MIL-STD-1223. Hardwood laminated flooring shall be brushed with a preservative conforming to MIL-W-13518 in lieu of pressure treating.

3.8.4.6 Weights, loads and dimensions.

3.8.4.6.1 Net weight.

The net weight of the complete semitrailer shall include the chassis weight and the weight of all attachments, accessories, and equipment (excluding internal Mobile CCTT equipment). The net weight shall be the minimum practicable.

3.8.4.6.2 Rated payload capacity.

The rated payload capacity, evenly distributed over the load space, shall be that required to support all internal Mobile CCTT equipment and personnel, but shall not be less than 10,886 Kilograms (Kg) (24,000 lbs).

3.8.4.6.3 Gross weight.

The Gross Vehicle Weight (GVW) of the semitrailer shall consist of its net weight plus its rated payload. The GVW shall not exceed ICC limits on gross semitrailer weight to include running gear.

3.8.4.6.4 Dimensions.

Dimensions and clearances shall be measured with the semitrailer fully loaded with its associated Mobile CCTT equipment, and the tires and suspension system adjusted to normal road conditions.

3.8.4.6.4.1 External dimensions.

The external dimensions shall be in accordance with 3.4.4 of MIL-S-45344 for a Type I, Class C, Size 48 semitrailer. Overall semitrailer length shall not exceed 14.6304 meters (m) (48 ft). Overall semitrailer width shall not exceed 2.5908 meters (m) (102 in.). Ground clearance for landing gear and leveling jacks shall not be less than 30.480 centimeters (cm) (12 in). The floor height and semitrailer width specified in MIL-S-45344 shall not be applicable to Mobile CCTT.

3.8.4.6.4.2 Interior dimensions.

The inside body dimensions shall be as follows:

a. Interior semitrailer width shall be the maximum allowable with good design practice considering necessary insulation and structural reinforcement for equipment mounting.

b. Interior semitrailer height—the distance from the floor to the bottom of lights, cable runs, and other protuberances over the aisles and standing work spaces—shall not be less than 1.981 m (78in). However, when the occupants seldom stand to perform normal operations, the ceiling height may be reduced to 1.893 m (74.5 in), unless otherwise directed by the Government.
c. The minimum opening for personnel access shall be 1.93 m (76 in) high and 760 mm (30 in) wide.

3.8.4.6.5 Wheel loading.

The tandem axles shall be positioned so that the proportion of the GVW supported on the tires, measured at the ground with Mobile CCTT payload installed, shall not impose a total wheel loading in excess of 15,422 Kg (34,000 lbs) (the total force of all semitrailer tires on the ground surface shall not exceed 15,422 Kg (34,000 lbs)).

3.8.4.7 Performance.

The semitrailer, fully equipped and loaded with rated payload, shall show no evidence of damage when tested as specified herein and when towed over improved roads at 105 Kilometers per hour (Km/hr) (65 mph) and improved gravel roads at 49 km/hr (30 mph) (see paragraph 6.5 of MIL-S-45344 for road type definitions). The semitrailer fully equipped and loaded with rated payload shall show no evidence of damage when towed over unimproved roads at an average speed of five miles per hour with a maximum speed of fifteen miles per hour. The air-ride suspension system shall be in accordance with paragraph 3.8.4.8.

3.8.4.7.1 Turning ability.

The semitrailer shall assume a 90 degree angle to the coupled towing vehicle without cramping and without damage to the semitrailer and the towing vehicle. The semitrailer shall be able to be towed and backed-up when coupled to a towing vehicle.

3.8.4.7.2 Tracking ability.

The semitrailer shall conform to the tracking requirements of DoT Federal Motor Carrier Safety Regulations, section 393.70(a).

3.8.4.7.3 Brake performance.

Service brakes shall comply with the performance requirements of DoT Federal Motor Carrier Safety Regulations, section 393.52 and the SAE Handbook.

3.8.4.7.4 Slope and grade.

The semitrailer, with payload, shall operate on a 0 to 20 percent grade and 0 to 12 percent side slope up and down the respective grades and slopes without malfunction. When the semitrailer is on the inclines specified herein, the semitrailer shall not interfere with components of the towing vehicle except where the upper fifth wheel plate is coupled to the towing vehicle fifth wheel.

3.8.4.8 Suspension system.

The semitrailer shall be furnished with a commercially available air-ride suspension system and shall be equipped with an air-ride upper fifth wheel. The suspension system shall attenuate the road-induced vibration and shock to the payload for the road conditions specified herein. The air suspension shall provide for automatic self load leveling air controls. Air release valve(s) shall be provided to facilitate semitrailer leveling.

The suspension system shall be designed for lifting the semitrailer off the ground. The suspension shall be supported so as not to bottom on the air bag and shock absorbers when lifted. The supports shall not inhibit the normal travel of the air-ride suspension.

The suspension system shall withstand the weight of the semitrailer, the payload, and a snow load of 2 Kilopascal (KPa) (42 lbs/ft^2) distributed over the entire roof. Clearance shall preclude interference between tires and all parts of the semitrailer under the operating conditions specified herein.

3.8.4.9 Axles.

The semitrailer shall be furnished with tandem axles. Axle ratings shall be at least equal to the load imposed, but shall in no case be less than 9,072 Kg (20,000 lbs) per axle measured at the ground.

The wheel bearings and axle spindles shall be oil lubricated. The oil viscosity shall be in accordance with the semitrailer manufacturer's recommendations. The hubcaps shall have a window for visual determination of oil level. The hubs shall be fitted with leakproof seals. Provisions for venting, or another method of withstanding internal pressure buildup, and for replenishing the oil supply shall be provided.

3.8.4.10 Wheels, rims tires and tubes.

3.8.4.10.1 Wheels, rims and tires.

The semitrailer shall be equipped with dual wheels on each axle. The rims and tire ratings shall conform to Tire and Rim Association (TRA) recommendations for the type and size of tires furnished or the tires shall conform to ZZ-T-381 with a size designation system the same as the Tire and Rim Association. Tires and rim sizes shall be the same for all wheels of the semitrailer. Tires shall be of a rated capacity at least equal to the load imposed on each tire, measured at each wheel at the ground, with the semitrailer loaded with its rated payload (3.8.4.6.2).

3.8.4.10.2 Inner tubes.

If tube type tires are furnished, inner tube shall be of heavy-duty type, and shall be of the proper size for the tires furnished. Tire flaps shall be provided for tube type tires in accordance with TRA recommendations.

3.8.4.10.3 Wheel and tire balancing.

Drums will be balanced to preclude abnormal tire wear, wheel thump and drumming up to the speeds specified in 3.8.4.7.

3.8.4.11 Rear wheel splash and stone throw protection.

The rear wheels shall have mud flaps at the rear. Splash and stone throw protection shall be in accordance with SAE J682.

3.8.4.12 Brakes.

3.8.4.12.1 Service brakes.

Service brakes shall be provided for the semitrailer. Service brakes shall be of the full air type and shall conform to DoT Federal Motor Carrier Safety Regulations, sections 393.45 through 393.47, and as specified herein. The braking system shall be equipped with automatic slack adjusters, piping, hose connections, gladhands, spring loaded dust covers or dummy gladhands equipped with security chains, and other components required for a complete air brake system. Gladhands shall conform to SAE J318. Air hose location shall comply with SAE J702. The braking system shall be installed in a manner which provides road clearance for travel over uneven terrain and protection against damage caused by objects striking components. No part of the braking system shall extend below the bottom of wheel rims.

3.8.4.12.2 Parking brakes.

Parking brakes shall be provided for the semitrailer in accordance with 3.6.4.2 of MIL-S-45344 with the following exception: parking brakes shall hold the semitrailer, with rated payload, on a 20 percent grade despite the depletion of the compressed air supply. The parking brakes shall conform to Federal Motor Carrier Safety Regulation, section 393.41.

3.8.4.13 Upper fifth wheel plate.

The upper fifth wheel plate shall be designed for coupling to a full oscillating and fore and aft rocking fifth wheel and shall support a fifth wheel 91.440 cm (36 in) in diameter. In addition, the coupling device shall conform to DoT Federal Motor Carrier Safety Regulations, section 393.70. The kingpin shall be of heat-treated alloy steel and shall conform to SAE J700. The forward end of the upper fifth wheel plate or skid plate shall have a turned-up lip for ease of coupling.

3.8.4.14 Landing gear and leveling jacks.

The semitrailer shall be supplied with landing gear in accordance with 3.6.7 of MIL-S-45344 with the following exceptions: each leg shall operate independently; and landing legs shall be equipped with self-leveling skid pads. The landing gear shall provide decoupling of each semitrailer with the air suspension upper fifth wheel from the towing vehicle. The landing gear shall also provide semitrailer leveling.

Two leveling jacks shall be provided on the rear of the semitrailer and shall conform to the same requirements as the landing gear. As a minimum, the landing gear and leveling jacks shall provide leveling of the semitrailer when on a slope of up to 5 degrees over the short dimension of the semitrailer and 1 degree over the long dimension of the semitrailer. Each leg of the landing gear and leveling jacks shall have minimum ground clearances of 30.480 cm (12 in).

3.8.4.15 Level indicators.

Four bubble level indicators shall be provided and shall be mounted on the exterior walls of the semitrailer. One shall be located on each side in a readable location and all four shall be protected from accidental damage. The level indicators shall permit readout of front-to-rear and side-to-side tilt within +/- 5 degrees.

3.8.4.16 Lifting and tiedown attachments.

When set up at a mobile site, the tie down attachments will prevent the fully loaded semitrailer from tipping and falling over due to wind speeds up to and including 202 Km/hr (125 mph). Tiedown attachments shall be based on the methods detailed in MIL-HDBK-1002/2. Tiedowns shall include the attachments points on each semitrailer and the cables, straps, or other means of tying down each semitrailer. Maximum shipping weight (MSW) shall be defined as the GVW of the semitrailer.

When set-up at a mobile site and when being transported as cargo by ship and rail, the tiedown attachments shall prevent the fully loaded semitrailer from tipping and falling over due to wind speeds up to and including 202 Km/hr (125 mph). Tiedowns shall include the attachment points on each semitrailer and the cables, chains, straps, or other means of tying down each semitrailer. Maximum Shipping Weight (MSW) shall be defined as the GVW of the semitrailer.

3.8.4.17 Rear end protection.

Rear end protection (bumper) shall be furnished in accordance with DoT Federal Motor Carrier Safety Regulations, section 393.86.

3.8.4.18 Lubrication.

Lubrication shall be in accordance with the manufacturer's standard practice. Lubrication means shall be provided for all parts of the equipment normally requiring lubrication. The lubricating points shall be easily visible and accessible. Hydraulic fittings used on the system will be in accordance with SAE 534. Where high lubrication pressure will damage grease seals and other parts, fittings with a pressure release mechanism shall be utilized.

3.8.4.19 Body construction.

Semitrailer body construction shall be in accordance with best commercial standards and as specified herein.

3.8.4.19.1 Platform.

The platform shall withstand the load of all equipment and personnel to be located within, but in no case shall the platform capacity be less than the rated payload capacity of 3.8.4.6.2.

3.8.4.19.2 Side wall and roof framing.

Outside side wall frame members shall be full length. Side wall posts and roof bows shall be spaced on not more than 60.960 cm (24 in) centers.

3.8.4.19.3 Roof.

The roof shall be of one piece and of stretcher level aluminum. A drip molding or rain gutter shall be provided over the doors. The roof shall withstand, without permanent deformation and degradation, the following:

a. A load of at least 115 Kg (253.5 lbs) concentrated in an area of one square foot at any location on the roof.

b. A snow load of at least 2 KPa (42 lbs/ft2) distributed over the entire roof.

3.8.4.19.4 Front end.

The front end shall have beveled or rounded corners which sacrifice a minimum of interior cube. The front end shall conform to the swing radius requirement of 133.350 cm (52.5 in) maximum and shall be in accordance with DoT bulkhead requirements.

3.8.4.19.5 External doors.

Door gaskets shall be installed with corners tightly fitted to provide a complete seal. Doors shall permit folding back against the body sides and shall be provided with a means for holding each door in the fully open position. A method for securely latching the doors in the fully closed position shall be provided. A lock and key shall be provided for each door. One key shall open all semitrailer body door locks. Doors for personnel ingress and egress shall be operable by personnel wearing arctic gloves. Doors shall have dimensions in accordance with 3.8.4.6.4.2.c. Personnel doors shall open from the inside when padlocked on the outside.

3.8.4.19.5.1 Rear doors.

The rear doors shall not be used as a personnel entrance/exit.

3.8.4.19.5.2 Other external doors.

Other exterior doors shall be provided as follows:

a. One or more emergency exit(s) shall be provided for safety purposes and shall provide access to and egress from the working spaces of the semitrailer. Each emergency exit shall be in accordance with best commercial standards. Location of the emergency exit(s) shall be dictated by the interior layout of the semitrailer. Marking and lighting of the emergency exit(s) shall be provided and shall conform to DoT Federal Motor Carrier Safety Regulations, section 393.92.

b. An external door or access panel in the ECS section of the semitrailer shall be provided which shall meet ECS installation and maintenance access requirements.

c. Additional external doors shall be installed as semitrailer layout and maintenance access dictate.

3.8.4.19.6 Thermal protection.

The semitrailer body shall be adequately insulated so that the body insulating efficiency shall not be reduced through the wall, door, floor, and roof sections. The insulation material shall be a nonhygroscopic, self-extinguishing, cellular material and shall be resistant to the growth of fungus and the retention of vermin. The insulation shall be sealed and bonded at all joints. The insulation shall be anchored to prevent sag and insulation voids. The insulation shall be properly vented to prevent the formation of ice and water between the walls. The average heat-loss per square foot per degree Fahrenheit of the semitrailer shall not exceed 0.3 BTU per hour.

3.8.4.20 Interior construction.

The interior construction shall be such that the interior acoustical noise levels shall be in accordance with 5.8.3 through 5.8.3.3.5 of MIL-STD-1472.

3.8.4.20.1 Walls and partitions.

The interior walls and partitions shall be securely fastened in place. They shall provide acoustical damping.

3.8.4.20.2 Ceiling.

The ceiling material shall provide acoustical damping. A false ceiling may be provided with spacing for ECS ducts, lighting installations, and access for air flow and temperature sensor maintenance.

3.8.4.20.3 Floors.

The interior floor shall provide a safe walking surface free of hazards (such as cables). A false floor structure may be provided. If it is provided, it shall be in accordance with NFPA-75, paragraph 2.4, and the following:

a. The false floor shall transfer all loads to the chassis frame.

b. The false floor structure shall permit underfloor longitudinal and lateral cabling between cabinets and equipment

c. The false floor design shall provide adequate clearance for and access to all cables and connections.

Floor covering shall be subject to authorization by the Government. The floor shall withstand a concentrated load of 300 lbs per square foot.

3.8.4.20.4 Interior doors.

The interior doors shall be solid core, and shall be weather-stripped for sound isolation. Doors for personnel access shall be in accordance with 3.8.4.6.4.2.c.

3.8.4.21 Lighting.

3.8.4.21.1 Semitrailer marker lighting.

All semitrailer marker lights and reflectors shall be protected from damage by mounting in recessed or otherwise guarded locations. The design and construction of the lamps shall be in accordance with DoT Federal Motor Carrier Safety Regulations, section 571.108. Requirements and placement of lamps, reflectors, and electrical wiring shall conform to DoT Federal Motor Carrier Safety Regulations, section 393.25 through 393.28 and 393.31. All electrical wiring shall conform to SAE J1292. Clearance and identification lights shall be constructed for easy removal and replacement of lamps and lenses without the use of special tools.

3.8.4.21.1.1 Twelve volt direct current system.

A 12 volt direct current (VDC) lighting system conforming to 3.8.4.21.1 shall be provided for the semitrailer. The 12VDC lighting system shall conform to DoT Federal Motor Carrier Safety Regulations, sections 393.14, 393.20, 393.22, 393.23, 393.25 through 393.29, 393.32 and 393.33.

3.8.4.21.1.2 Receptacle, 12VDC.

The front of the semitrailer shall be equipped with a 7 contact, 12VDC receptacle conforming to SAE J560 with the connectors connected and color coded as specified therein. The receptacle shall be provided with a spring loaded cover. The receptacle shall be located in accordance with SAE J702.

3.8.4.21.1.3 Interconnected 24VDC system.

Hardware to operate the 12VDC system (see 3.8.4.21.1.1) from a towing vehicle equipped with a nominal 24VDC electrical system shall also be provided. The 12 contact receptacle of 3.4.21.1.4 shall be provided with resistance in each circuit to reduce the voltage provided by the towing vehicle from a nominal 24VDC to 12VDC in accordance with 3.6.6.6 of MIL-S-45344.

3.8.4.21.1.4 Receptacle, 24VDC.

The front of the semitrailer shall be equipped with a 12 contact, 24VDC receptacle and cover conforming to MS75021, part number MS75021-1, and 3.6.6.5 of MIL-S-45344. The receptacle shall be located in accordance with SAE J702.

3.8.4.21.2 Interior lighting.

3.8.4.21.2.1 Normal lighting.

Recessed light fixtures shall be supplied in sufficient quantity to provide lighting levels for all personnel areas in accordance with 5.8.2 of MIL-STD-1472. If different illumination criteria are applicable for a single area, the highest recommended illumination level shall be provided for the entire area.

3.8.4.21.2.2 Emergency lighting.

Emergency lighting shall be provided for all personnel areas. The lighting units shall be in accordance with W-L-305, shall be Type 1, Class 1, Style E, Kind 2, and shall be supplied with the equipment specified therein. The battery power supply furnished shall be 12 volt. The 12 volt battery power supply shall be furnished with a battery charger which operates from a 120 volt, 60 Hz, source of power. A switch shall be provided to disable the lamps during storage and transit. A battery charge indicator shall be provided.

3.8.4.21.3 Exterior lighting.

Exterior lighting shall be supplied in sufficient quantity to provide lighting levels in accordance with 5.8.2 of MIL-STD-1472 for the set up and dismantling of the mobile configuration and for night operations. The exterior lighting units shall be supplied with a 12 volt battery power supply. The exterior lighting units shall utilize the 12 volt battery power supply and shall be provided with a charger which operates from a 120 volt, 60 Hz, source of power. A switch shall be provided to disable the lights during storage and transit. A battery charge indicator shall be provided. The exterior lights shall also utilize the power of 3.8.4.31 in place of battery power.

3.8.4.22 External platforms, railings, and stairways.

External platforms, railings, and stairways shall be provided for access to and egress from the semitrailer doors which serve as entrance/exit doors. These platforms, railings, and stairways shall be set up, dismantled, stored, and transported by two people without opening the semitrailer body. A platform shall be provided at the top of each stairway to permit opening of the doors from the outside. The platforms and stairways shall have an expanded metal grating type of tread to permit drainage. The upper surface of each tread shall have a serrated pattern. The platforms and stairways shall have independently operating adjustable legs to provide a means of height adjustment to compensate for uneven terrain. Step surfaces shall remain level and horizontal regardless of stair angle. Collapsible railings shall be provided on both sides of each stairway and around each platform. Provisions shall be made for the secure stowage of platforms, railings, and stairways while in transit. One or more removable ladders shall be provided for access to all maintenance door(s) on the exterior of the semitrailer. One or more protective enclosures (such as a tarp) shall be provided to be used to shelter the external maintenance door(s) from the environment during foul weather maintenance. The platforms, railings, and stairways shall be in accordance with 5.7.7 of MIL-STD-1472.

3.8.4.23 Environmental Control System (ECS).

An ECS shall be provided as specified herein and in accordance with 5.8 through 5.8.1.8 of MIL-STD-1472. The ECS shall automatically control the environment within the semitrailer when at a stationary location for Mobile CCTT training. The ECS shall be designed for a variable space control point temperature set by a thermostat. After initial power up of the ECS, the time required for the ECS to bring the interior temperature of the semitrailer from the temperature extremes specified in 3.8.2.2 to 23.0 +/- 0.5 degrees C (73.4 +/- 1.0 degrees F) shall not exceed four hours. After this initialization period, the ECS shall maintain (with the tolerances specified in 3.8.4.23.3) the semitrailer interior temperature at the thermostatically selected temperature for all semitrailer exterior temperatures within the extremes specified in 3.8.2.2. The casing of the ECS units shall be isolated from the semitrailer body to preclude vibrations from being transmitted to the semitrailer body.

3.8.4.23.1 Cooling unit(s).

The cooling unit(s) of the ECS shall consist of at least the basic components, compressor, condenser coil and fan, and evaporator coil and fan, complete with all necessary controls, piping, valves, and refrigerants required for normal operation. If two separate cooling units are provided, an automatic switching arrangement shall be provided to alternate operation of the units when the cooling load is low and requires operation of only one unit. A refrigerant head pressure control shall be provided to prevent evaporator freezing and to allow operation of the cooling units until the outside ambient temperature falls to that point below the freezing temperature where the interior heat gain balances with the heat loss to the exterior and cooling is no longer required.

3.8.4.23.2 Heating.

The heaters of the ECS shall be in accordance with best commercial practice. Two high temperature limit switches (primary and supplementary) shall be provided and shall be Underwriters Laboratories (U.L.) listed. The primary limiting switch shall be an automatic resetting type and shall automatically open all contact holding coil circuits when the temperature of the surface nearest the heating elements exceeds the normal operating range. The supplementary temperature limiting switch shall be a manual reset type and shall automatically open all heater contact holding coil circuits when the temperature of the surface nearest the heating elements reaches a temperature which may cause equipment damage and a hazard to personnel. The supplementary temperature limit switch shall be located in a readily accessible location and be manually reset without removing panels from the heater enclosure. An air proving switch or similar device shall be incorporated which shall de-energize the heaters in case of fan failure. Heaters will be U.L. approved.

3.8.4.23.3 Control circuits.

The control thermostat for the ECS shall have a +/- 0.8°C (+/- 1.5°F) response differential. Control set-point shall be adjustable. The control system shall respond to control point temperature changes to maintain the thermostat set-point +/- 0.8°C (+/- 1.5°F) at the controller and +/- 2°C (+/- 3.6°F) throughout the semitrailer at a level of 5 feet above the floor. Necessary switches, thermostats, and humidistats shall be provided and installed. Controls shall provide for the following: (excluding PPS ECU)

a. An ”OFF” setting which de-energizes the entire ECS.

b. A ”VENT” setting which de-energizes the entire ECS with exception of the evaporator fan (in case of excess relative humidity in ”VENT” mode, humidistat overrides ”VENT” and starts cooling and heating unit).

c. An ”AUTO” setting which energizes and de-energizes the cooling unit and heater as conditions require.

d. A manual switch which shall be variable in order to select from 0 to 100 percent return air with outside ambient air.

3.8.4.23.4 Air filters.

Air filters for the ECS shall be placed in the return air plenum in a manner that both return air and outside air flow through a filter prior to reaching the cooling coil. Filters shall be sized for a face velocity not to exceed 91.4 meters per minute (300 ft/min). Filters shall be located in an easily accessible position for replacement and inspections.

3.8.4.23.5 Maintainability.

All ECS equipment shall be maintainable without removing it from the semitrailer.

3.8.4.24 Humidity control.

An electrically powered device, which may be part of the ECS of 3.8.4.23, shall be provided and shall automatically control the interior humidity level of the semitrailer. The device shall maintain the interior humidity at a level beneficial to both equipment and personnel. The device shall automatically increase and decrease the semitrailer interior humidity (except for the ECS area if isolated from the trainer area) during periods of site use. A water supply tank for the humidity device shall be located within the semitrailer. A non-powered method for controlling humidity to prevent interior equipment damage during periods of storage shall also be provided.

3.8.4.25 Fire extinguishers.

Fire extinguishers shall be furnished in accordance with paragraph 3.3.3.2 and shall be provided with brackets to secure the fire extinguishers during both transit and site use.

3.8.4.26 Alarm system.

3.8.4.26.1 Security Alarm.

An electronic alarm system operating from a rechargeable battery power source shall be provided in each semitrailer and shall sound an external noise source (siren) in the event of an unauthorized entry into the semitrailer. A battery power source, battery charger, siren, and all wiring, sensors, and control circuitry shall be provided. A means shall be provided to set and disarm the system from inside the semitrailer.

3.8.4.26.2 Fire Detection System.

A Fire Detection System shall be provided which shall detect the onset of a possible emergency. The system shall meet with NFPA Code 101 for the design of the Fire Detection System and shall meet NFPA 70 and 72 for the installation, test, and maintenance of the system. Components used in the Fire Detection System shall be UL approved.

3.8.4.26.2.1 Simulator Module Fire Detection System.

Mobile CCTT Module Fire Detection System-Each CCTT manned module compartment shall provide a fire detection system which detects the onset of a possible emergency. The system shall meet the NFPA Code 101 for the design of the fire detection system and shall meet NFPA 70 and 72 (Aug 1993) for the installation, test, and maintenance of the system. Components used in the fire detection system shall be UL approved. The system shall also meet the following:

a. Power and signal cable groups shall be isolated from fire alarm cables.

b. Activation of the module fire detection system shall sound an alarm inside the module compartment(s) and shall trigger internal alarms in compartments of all modules and shall trigger all internal and external semitrailer Fire Detection System alarms in the mobile CCTT configuration.

c. Simulator Module Fire Detection System strobe lights shall be provided on the exterior of the semi-trailers. One stobe light per simulator module shall be mounted near the entry door for that semitrailer and shall be illuminated in the event of a fire in the associated module. Activation of one simulator module’s Fire Detection System shall not trigger strobes on any other module.

d. A power interrupt indication shall be displayed on the MCC and MC.

e. Activation of a module’s fire detection system shall deactivate power within the module.

f. Each module’s fire detection system shall incorporate a battery backup ability that will allow the fire detection system to remain operational for a minimum of twenty four (24) hours after the removal of power.

g. Activation of the Facility Fire Detection System shall not trigger strobes on any modules or semitrailers.

h. Activation of the Facility’s Fire Detection System shall activate the internal alarms in all compartments, all modules, and all semitrailers.

3.8.4.26.2.2 Semitrailer Fire Detection System.

In addition to the Simulator Module Fire Detection System, each Mobile CCTT semitrailer shall be provided with a fire detection capability which shall detect the onset of a possible emergency.

The Semitrailer Fire Detection System shall also meet the following:

a. Power and signal cable groups shall be isolated from fire alarm cables.

b. A power interrupt indication shall be displayed on the MCC and MC.

c. The system shall provide an output interface for the facility fire alarm system and shall trigger the facility alarm when connected to the facility.

d. The system shall incorporate a battery backup ability that shall allow the system to remain operational for a minimum of twenty four (24) hours after the removal of power.

e. Activation of the system shall sound the internal and external alarms of the semitrailer and shall trigger all semitrailer and simulator module alarms within the Mobile CCTT configuration.

f. For Semitrailers with simulator modules, activation of the Semitrailer Fire Detection System shall trigger the strobe of the simulator module nearest the fire on the outside of the affected semitrailer.

g. For Semitrailers without simulator modules, the semitrailer fire detection system strobe lights shall be installed on the exterior of the semitrailers. One strobe light per semitrailer compartment shall be mounted near the entry door for that compartment and shall be illuminated in the event of a fire in the associated compartment. Activation of one of the semitrailer compartment's fire detection systems shall not trigger strobes on any other module or semitrailer.

h. Activation of the system shall deactivate all power within the semitrailer.

3.8.4.26.2.3 Manual Fire Alarm Stations.

Manual fire alarm stations shall be located at each door of each semitrailer. Each manual fire alarm shall provide for the following:

a. Activation of the manual fire alarm shall sound the internal and external alarms of the semitrailer and shall trigger all other semitrailer and simulator module alarms within the Mobile CCTT configuration.

b. Activation of the manual fire alarm shall shut off all power in the semitrailer.

c. Activation of the manual fire alarm shall illuminate the strobe on the outside of the affected semitrailer nearest to the manual pull station.

3.8.4.27 Telephone system.

The semitrailer shall contain a telephone with all telephones (multi-trailer configuration) connected on the same telephone line. External telephone cables and attachments shall be furnished so that the telephone system operates properly when the telephone cable is connected to an appropriate service point. A means shall be provided to secure the telephones during transit.

3.8.4.28 Furniture and chairs.

The semitrailer shall be furnished with all the furniture and chairs necessary for that portion of the Mobile CCTT configuration to be located within the particular semitrailer. Chairs shall be of the same design and construction as specified for the fixed site version of CCTT. All tables and work surfaces shall be of sturdy construction and shall be finished with a high-pressure laminate. Colors will be specified by the Government. All furniture and chairs shall be securely mounted to the semitrailer or provided with a means for securing during transit.

3.8.4.29 Provisions for maintenance work space.

Maintenance work space may be located in one or more semitrailers or a separate maintenance van.
In addition to aisle space and general equipment accessibility, work space shall be provided with the following features:

a. Location shall be convenient to the storage area for data and publications.

b. Use during training shall not interfere with instructors.

c. Illumination shall be sufficient for reading technical data as specified in 3.8.4.21.2.1.

d. A raised work surface shall be provided to facilitate use of maintenance publications and data by two technicians. The work surface shall be a minimum of 61 cm (24 in) by 122 cm (48 in) horizontal.

3.8.4.30 Provisions for storage of support equipment and materials.

Adequate and convenient storage facilities shall be provided for the following:

a. Contractor maintenance level tools and test equipment identified on the Government-approved Tools and Test Equipment List of the contract.

b. Contractor maintenance level spare parts required to adequately support mobile operations.

c. Operations and maintenance manuals and other technical documentation (including drawings) required to support the system and identified on the Government-approved Custody and Inventory Record.

d. Carry-on units, cables, magnetic tapes and discs, printer paper, hard copy device paper, and all other non-mounted trainer equipment.

e. Undercarriage storage may be utilized for stowage of stairways, platforms, railing, and with provisions for latching them in both the fully open and closed positions. Each door shall be provided with a lock and key. One key shall open all undercarriage door locks. Access to the undercarriage storage compartments shall be from the exterior of the semitrailer only.

Storage facilities may be provided in semitrailers or a maintenance van or both. All doors and drawers shall have provisions for latching to ensure security during transit. Compartments and storage cabinets shall be compartmented to segregate different types of items and be provided with slide-out or removable bins or drawers for small, loose piece parts. Shock mounting shall be provided for test equipment and items sensitive to vibration. However, all equipment shall be easily removed for portable use in the maintenance function. In addition, stored items shall occupy no more than 80 percent of the storage space. Storage facilities shall be illuminated to a level equivalent to maintenance areas and shall have provisions for air exchange with the semitrailer interior for temperature and humidity equalization. Accessibility (except for undercarriage storage) shall be provided only from the interior of the semitrailer.

3.8.4.31 Electrical system.

A 120V, 60 Hz electrical system shall be installed in the semitrailer in accordance with the National Electric Code (NFPA 70-1990) and as specified herein. The semitrailer shall be provided with emergency circuit breaker(s) in accordance with section 645-10 of NFPA 70-1990.

3.8.4.31.1 Internal.

a. The following shall be provided:

b. Power for computers, simulators, and lighting and for electrical receptacles as necessary for maintenance equipment.

c. Extra electrical receptacles, in addition to those necessary for computers and equipment, a minimum of four per compartment. Receptacles shall be in accordance with 3.2.7.5.5. If both conditioned and unconditioned power receptacles are provided, conditioned power receptacles shall be visibly different in color or marking from unconditioned receptacles.

d. Light switches, to operate the interior semitrailer lighting of 3.8.4.21.2.1, a minimum of one per external door.

3.8.4.31.2 External utility assemblies.

External electrical assemblies shall be rated weatherproof in accordance with the National Electric Code (NFPA 70-1990).

3.8.4.32 External panels and cables.

A means shall be provided at one location of the semitrailer for connecting semitrailer power, communications, and trailer-to-trailer cabling. Externally mounted connectors shall be provided at a panel and shall be sheltered from the elements.

Watertight protective caps shall be provided for all external cable and panel connectors for use in transit. These protective caps shall be securely attached to their associated connectors to preclude loss. Cable jackets and connector connections shall be resistant to cracking and deteriorating when exposed for long periods of time to water, snow, freezing, and sunlight. All external connections and cables shall be weatherproof.

Storage for cables shall be provided. A suitable means (such as connector keying) shall be provided to preclude incorrect cable connections. All cables shall travel from trailer-to-trailer without impeding vehicular and personnel traffic and shall be protected from damage from such traffic. All cable lengths shall be sufficient to meet the requirements for all mobile sites and shall be subject to authorization by the Government.

3.8.4.33 Usable life of trailer.

The semitrailer shall have a usable life of 15 years with only routine maintenance and refurbishment accomplished during the 15 year period of time.

3.8.5 Portable Power System (PPS).

The PPS shall provide all power for the Mobile CCTT configuration. The PPS shall meet the required needs of Mobile CCTT. Power line conditioners and regulators shall be provided and installed to protect the equipment from power fluctuations, sags, surges, and transients.

The PPS shall derive power from two separate sources as follows:

a. Electrical Generators.

b. Hard-wire to raw commercial site power as defined in 3.2.7.5.

The PPS shall provide on-site selection via a switch of any one of the sources of 3.8.5.a through b. The PPS shall power the entire Mobile CCTT configuration from the selected source alone. The PPS shall be equipped with the electrical generator(s) which may be located within one or more semitrailers. Generator(s) shall be powered by diesel fuel and shall have a power factor of no less than a value of 0.8. Smoke output from the generator(s) shall be minimized. All cables and connectors to connect the PPS to the commercial site power shall be provided.

3.8.5.1 Design.

The PPS design shall meet the requirements of the National Electrical Code (NFPA 70-1990).

3.8.5.2 Power distribution.

The PPS shall house the main service panel for all semitrailers. Feeders shall be run from this panel to the Mobile CCTT semitrailers. Meters and associated circuitry shall be provided which shall measure and display the voltage and current of each phase.

3.8.5.3 Noise.

The noise produced by the PPS shall be in accordance with MIL-STD-1474. The noise shall be attenuated to the maximum extent practicable, but shall not exceed the limits specified in sections 5.3 through 5.3.2 of MIL-STD-1474. Hearing protection shall not be required at the Mobile CCTT training site.

3.8.5.4 Deleted

3.9 Preplanned program improvements (P3I) for CCTT.

4. Quality Assurance Provisions.

4.1 Responsibility For Inspection.

Unless otherwise specified in the contract, the contractor is responsible for the performance of all inspections requirements as specified herein. Except as otherwise specified in the contract or purchase order, the contractor may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements. For all Government performed inspections, the contractor shall be responsible for providing technical support to the inspection.

4.1.1 Responsibility For Compliance.

All items must meet the requirements of Sections 3, 5 and Appendices of the specification. The inspections set forth in the specification shall become part of the contractor's overall inspection system or quality program. The absence of any inspection requirements in the specification shall not relieve the contractor of the responsibility of assuring that all products or supplies submitted to the Government for acceptance comply with all requirements of the contract. Sampling in quality conformance does not authorize submission of known defective material, either indicated or actual, nor does it commit the Government to the acceptance of defective material.

4.1.2 Qualification Methods.

The matrix in Table IV specifies the method of verification/qualification for all requirements at the paragraph level of Section 3 of this specification and Section 30s of Appendices A, and F through L. Verification/qualification methods at the requirement level will be contained in the Requirements and Traceability Management (RTM) database. Failure of any CCTT major component to pass one or more of the requirements shall constitute failure of qualification inspection. Each column shall be defined as follows:

a. Requirement. This column lists the applicable paragraph of Section 3 and Section 30s of Appendices A, and F through L herein to be verified.

b. Not Applicable (N/A). This column will show an "X" if the particular paragraph cannot or will not be verified.

c. Examination. For each requirement with a corresponding "X" in this column, the contractor shall show that the requirement has been met through inspection consisting of investigation without the use of special laboratory appliances or procedures, or supplies and services to determine conformance to the specified requirements which can be determined by such investigations. Examination is generally nondestructive and includes visual, auditory, olfactory, tactile, and other investigations; simple physical manipulation; gauging; and measurements.

d. Analysis. For each requirement with a corresponding "X" in this column, the contractor shall show that the requirement has been met through review of applicable documentation. Verification shall be by mathematical or statistical analysis, comparing the correlation of measured data and observed test results with calculated expected values, and conformance of end items with contractor-generated specifications and documentation from lower tier suppliers, as well as Government-approved configuration items specifications and documentation.

e. Demonstration. For each requirement with a corresponding ”X” in this column, the contractor shall show through actual exercise of the equipment that the requirement has been met.

f. Test. For each requirement with a corresponding ”X” in this column, the contractor shall demonstrate to the Government that the requirement has been met through the determination by technical means of the properties or elements of the trainer, or components thereof, including functional operation and involving the application of established scientific principles and procedures. Test shall consist of measurement, calculation, other accepted scientific means or a combination of the three to establish that the performance requirements of this specification are met.

g. Certification. For each requirement with a corresponding ”X” in this column, the contractor shall provide a certification to verify that the requirement has been met. Certifications must include documented test results, performance data, analytical data or vendor documentation. The certifications must be made available to the Government representatives immediately upon request for review during inspections.

Table IV. Verification/Qualification Method

REQUIREMENT	N/A	EXAM	ANALYSIS	DEMO	TEST	CERT.
3.	X					
3.1		X				
3.1.1	X					
3.1.2		X		X		
3.1.3	X					
3.1.3.1	X					
3.1.3.1.1		X		X		
3.1.3.1.2	X					
3.1.3.1.3	X					
3.1.3.1.4	X					
3.1.3.1.5		X				
3.1.3.1.6	X					
3.1.3.2	X					
3.1.3.2.1	X					
3.1.3.2.1.1		X		X		
3.1.3.2.1.2 - 3.1.3.2.2.7	X					
3.2		X			X	

Table IV. Verification/Qualification Method

REQUIREMENT	N/A	EXAM	ANALYSIS	DEMO	TEST	CERT.
3.2.1		X		X		
3.2.1.1				X	X	
3.2.1.2				X	X	
3.2.1.3		X			X	
3.2.2	X					
3.2.2.1			X	X		
3.2.2.2			X	X		
3.2.3			X			
3.2.4	X				X	
3.2.5		X			X	
3.2.5.1			X		X	
3.2.6	X					
3.2.7	X					
3.2.7.1			X			
3.2.7.2		X				
3.2.7.3		X				
3.2.7.4		X				
3.2.7.5			X		X	
3.2.7.5.1			X		X	
3.2.7.5.2		X				
3.2.7.5.3			X		X	
3.2.7.5.4	X					
3.2.7.5.5		X				
3.2.7.6			X	X		
3.2.7.7		X			X	
3.2.7.8		X			X	
3.2.7.8.1		X				
3.2.7.9						X
3.2.7.10		X				
3.2.8	X					
3.2.8.1			X	X		
3.2.8.2			X		X	

Table IV. Verification/Qualification Method

REQUIREMENT	N/A	EXAM	ANALYSIS	DEMO	TEST	CERT.
3.2.9			X			
3.2.9.1			X	X		
3.2.9.2	X					
3.2.9.2.1				X		
3.2.9.2.1.1				X		
3.2.9.2.1.2				X		
3.2.9.2.1.3				X		
3.2.9.2.2				X		
3.2.9.2.3		X				
3.2.9.2.4		X				
3.2.9.2.4.1		X				
3.2.9.2.4.2		X				
3.2.9.2.4.3		X				
3.2.9.2.4.4		X				
3.2.9.2.4.5		X				
3.2.9.2.4.6		X				
3.2.9.2.4.7		X				
3.2.9.3		X				
3.2.9.3.1		X				
3.2.9.3.2		X				
3.2.10	X					
3.2.10.1			X			X
3.2.10.2			X			X
3.2.10.3			X			X
3.2.10.4			X			X
3.2.10.5			X			X
3.2.11		X	X			
3.3	X					
3.3.1		X				X
3.3.2	X					
3.3.2.1			X	X	X	
3.3.2.2			X		X	

Table IV. Verification/Qualification Method						
REQUIREMENT	**N/A**	**EXAM**	**ANALYSIS**	**DEMO**	**TEST**	**CERT.**
3.3.2.3	X					
3.3.2.4					X	
3.3.2.5		X				
3.3.3		X				
3.3.3.1		X				
3.3.3.2		X				
3.3.3.3		X				
3.3.3.4		X				
3.3.4		X				
3.4	X					
3.5	X					
3.5.1		X				
3.5.2		X				
3.6		X				
3.6.1		X		X		
3.6.1.1		X		X		
3.6.1.2		X		X		
3.6.1.3		X		X		
3.6.1.4		X		X		
3.6.1.5		X		X		
3.6.2		X		X		
3.6.3	X					
3.6.4		X	X	X		
3.6.5		X	X	X		
3.6.6		X	X	X		
3.6.7		X		X		
3.6.8		X		X		
3.7	X					
3.7.1		X		X		
3.7.1.1			X	X		
3.7.1.2				X		
3.7.1.2.1				X		

Table IV. Verification/Qualification Method						
REQUIREMENT	**N/A**	**EXAM**	**ANALYSIS**	**DEMO**	**TEST**	**CERT.**
3.7.1.2.2				X		
3.7.1.3			X	X		
3.7.1.4			X	X		
3.7.1.5			X	X		
3.7.1.6			X	X		
3.7.1.7		X		X		
3.7.2		X		X		
3.7.2.1		X		X		
3.7.2.1.1				X		
3.7.2.1.2		X		X		
3.7.2.1.2.1		X		X		
3.7.2.1.2.2		X		X		
3.7.2.1.2.3		X		X		
3.7.2.1.3		X		X		
3.7.2.1.4		X				
3.7.2.2		X		X		
3.7.2.2.1		X				
3.7.2.2.1.1				X		
3.7.2.2.1.2				X		
3.7.2.2.1.3				X		
3.7.2.2.2				X		
3.7.2.2.3				X		
3.7.2.2.4				X		
3.7.2.2.5		X				
3.7.2.2.6		X		X		
3.7.2.2.7				X		
3.7.2.2.8		X		X		
3.7.2.3		X		X		
3.7.3		X				
3.7.3.1						X
3.7.3.1.1		X				
3.7.3.1.2			X	X		

Table IV. Verification/Qualification Method						
REQUIREMENT	**N/A**	**EXAM**	**ANALYSIS**	**DEMO**	**TEST**	**CERT.**
3.7.3.1.3	X					
3.7.3.1.4				X		X
3.7.3.1.5			X	X		
3.7.3.2		X	X	X		
3.7.3.2.1		X	X	X		
3.7.3.2.1.1		X				
3.7.3.2.2		X	X			X
3.7.3.2.3		X	X		X	X
3.7.3.3		X		X		
3.7.3.3.1		X	X	X		
3.7.3.3.2		X	X	X		
3.7.3.3.3		X	X	X		
3.7.4		X				
3.7.4.1			X	X		
3.7.4.2		X				
3.7.4.3			X	X		
3.7.4.4		X				
3.7.4.5			X	X		
3.7.5	X					
3.7.6				X	X	
3.7.7	X					
3.7.8	X					
3.7.9	X					
3.7.10		X			X	
3.7.10.1		X			X	
3.7.10.1.1		X			X	
3.7.10.1.2		X			X	
3.7.10.2				X		
3.7.10.2.1				X		
3.7.10.2.2		X		X		
3.7.10.2.3		X		X	X	
3.7.10.2.4				X		

Table IV. Verification/Qualification Method

REQUIREMENT	N/A	EXAM	ANALYSIS	DEMO	TEST	CERT.
3.7.10.3	X					
3.7.10.3.1				X		
3.7.10.3.2				X		
3.7.10.4				X		
3.7.10.5		X		X		
3.7.10.5.1		X		X		
3.7.10.6			X	X		
3.7.10.6.1			X	X		
3.7.10.6.2			X	X		
3.7.10.6.3			X	X		
3.7.10.6.4			X	X		
3.7.10.6.5			X	X		
3.7.10.6.6			X	X		
3.7.10.6.7			X	X		
3.7.11	X					
3.7.12	X					
3.7.13	X					
3.7.14	X					
3.8		X			X	
3.8.1		X			X	
3.8.2					X	
3.8.2.1		X			X	
3.8.2.2		X			X	
3.8.2.3		X			X	
3.8.3					X	
3.8.4		X			X	
3.8.4.1						X
3.8.4.2						X
3.8.4.3						X
3.8.4.4						X
3.8.4.5						X
3.8.4.6		X				

Table IV. Verification/Qualification Method						
REQUIREMENT	**N/A**	**EXAM**	**ANALYSIS**	**DEMO**	**TEST**	**CERT.**
3.8.4.6.1		X				
3.8.4.6.2		X				
3.8.4.6.3		X				
3.8.4.6.4		X				
3.8.4.6.4.1		X				
3.8.4.6.4.2		X				
3.8.4.6.5		X				
3.8.4.7					X	
3.8.4.7.1					X	
3.8.4.7.2					X	
3.8.4.7.3					X	
3.8.4.7.4					X	
3.8.4.8		X			X	
3.8.4.9		X			X	
3.8.4.10		X			X	X
3.8.4.10.1		X			X	X
3.8.4.10.2		X			X	X
3.8.4.10.3		X			X	X
3.8.4.11		X				X
3.8.4.12		X			X	X
3.8.4.12.1		X			X	X
3.8.4.12.2		X			X	X
3.8.4.13		X			X	X
3.8.4.14		X			X	
3.8.4.15		X			X	
3.8.4.16		X			X	X
3.8.4.17		X				X
3.8.4.18		X				X
3.8.4.19		X			X	
3.8.4.19.1		X			X	
3.8.4.19.2		X				
3.8.4.19.3		X			X	

Table IV. Verification/Qualification Method						
REQUIREMENT	**N/A**	**EXAM**	**ANALYSIS**	**DEMO**	**TEST**	**CERT.**
3.8.4.19.4		X				
3.8.4.19.5		X			X	
3.8.4.19.5.1		X			X	
3.8.4.19.5.2		X			X	X
3.8.4.19.6		X			X	
3.8.4.20		X				
3.8.4.20.1		X				
3.8.4.20.2		X				
3.8.4.20.3		X				
3.8.4.20.4		X				
3.8.4.21	X					
3.8.4.21.1		X			X	X
3.8.4.21.1.1		X				X
3.8.4.21.1.2		X				X
3.8.4.21.1.3		X			X	
3.8.4.21.1.4		X				X
3.8.4.21.2	X					
3.8.4.21.2.1		X			X	
3.8.4.21.2.2		X				
3.8.4.21.3		X			X	
3.8.4.22		X		X		
3.8.4.23		X			X	
3.8.4.23.1		X				
3.8.4.23.2		X			X	
3.8.4.23.3		X				
3.8.4.23.4		X				X
3.8.4.23.5					X	
3.8.4.24		X			X	
3.8.4.25		X			X	
3.8.4.26		X			X	
3.8.4.27		X			X	
3.8.4.28		X			X	X

Table IV. Verification/Qualification Method						
REQUIREMENT	**N/A**	**EXAM**	**ANALYSIS**	**DEMO**	**TEST**	**CERT.**
3.8.4.29		X				
3.8.4.30		X			X	
3.8.4.31		X			X	X
3.8.4.31.1		X			X	X
3.8.4.31.2		X			X	X
3.8.4.32		X			X	X
3.8.4.33	X					
3.8.5		X			X	X
3.8.5.1		X			X	X
3.8.5.2		X			X	X
3.8.5.3		X			X	X
3.8.5.4		X			X	X
3.9	X					
A.30.1.1		X				
A.30.1.1.1		X				
A.30.1.1.2		X		X		
A.30.1.1.3		X		X		
A.30.1.2.1				X		
A.30.1.2.2				X		
A.30.1.2.3				X		
A.30.1.2.4				X		
A.30.1.2.5				X		
A.30.2.1				X	X	
A.30.2.1.1				X	X	
A.30.2.1.1.1				X		
A.30.2.1.1.2				X	X	
A.30.2.1.1.2.1				X	X	
A.30.2.1.1.2.2				X	X	
A.30.2.1.1.2.3				X	X	
A.30.2.1.1.2.4				X		
A.30.2.1.1.2.5				X		
A.30.2.1.1.2.6				X		

Table IV. Verification/Qualification Method						
REQUIREMENT	**N/A**	**EXAM**	**ANALYSIS**	**DEMO**	**TEST**	**CERT.**
A.30.2.1.1.2.7				X		
A.30.2.1.2				X		
A.30.2.1.2.1				X	X	
A.30.2.1.2.1.1		X		X	X	
A.30.2.1.2.1.2		X		X	X	
A.30.2.1.2.1.3		X		X	X	
A.30.2.1.2.1.4				X		
A.30.2.1.2.1.5	X					
A.30.2.1.2.1.6				X		
A.30.2.1.2.1.7	X					
A.30.2.1.2.2				X		
A.30.2.1.2.2.1					X	
A.30.2.1.2.2.2					X	
A.30.2.1.2.2.2.1				X		
A.30.2.1.2.2.2.2				X		
A.30.2.1.2.2.2.3				X		
A.30.2.1.2.3				X		
A.30.2.1.2.4	X					
A.30.2.1.2.4.1				X		
A.30.2.1.2.4.2				X		
A.30.2.1.2.4.3	X					
A.30.2.1.2.4.3.1				X		
A.30.2.1.2.4.3.2				X		
A.30.2.1.2.4.3.2.1				X		
A.30.2.1.2.4.3.2.2				X		
A.30.2.1.2.4.3.2.2.1				X		
A.30.2.1.2.4.3.3				X		
A.30.2.1.2.5	X					
A.30.2.1.2.5.1			X		X	
A.30.2.1.2.5.2			X	X	X	
A.30.2.1.2.5.2.1			X	X	X	
A.30.2.1.2.5.2.2			X	X	X	

Table IV. Verification/Qualification Method						
REQUIREMENT	**N/A**	**EXAM**	**ANALYSIS**	**DEMO**	**TEST**	**CERT.**
A.30.2.1.2.5.2.3				X		
A.30.2.1.2.5.2.4				X	X	
A.30.2.1.2.5.2.5				X	X	
A.30.2.1.2.5.3				X	X	
A.30.2.1.3				X	X	
A.30.2.1.3.1	X					
A.30.2.1.3.2					X	
A.30.2.1.3.2.1					X	
A.30.2.1.3.2.2					X	
A.30.2.1.3.3					X	
A.30.2.1.3.3.1					X	
A.30.2.1.3.4					X	
A.30.2.1.3.5				X	X	
A.30.2.1.3.5.1					X	
A.30.2.1.3.5.2					X	
A.30.2.1.3.6					X	
A.30.2.1.3.6.1					X	
A.30.2.1.3.6.2					X	
A.30.2.1.3.7					X	
A.30.2.1.3.8					X	
A.30.2.1.3.9				X	X	
A.30.2.1.3.10					X	
A.30.2.1.3.11					X	
A.30.2.1.3.12			X		X	
A.30.2.1.3.13				X		
A.30.2.1.3.14				X		
A.30.2.1.3.15				X		
A.30.2.1.3.16				X		
A.30.2.1.4	X					
A.30.2.1.5			X	X	X	
A.30.2.1.5.1			X	X	X	
A.30.2.1.5.1.1			X	X		

Table IV. Verification/Qualification Method						
REQUIREMENT	**N/A**	**EXAM**	**ANALYSIS**	**DEMO**	**TEST**	**CERT.**
A.30.2.1.5.2			X	X		
A.30.2.1.5.2.1			X	X		
A.30.2.1.5.2.2			X	X		
A.30.2.1.5.2.3			X	X		
A.30.2.1.5.2.4			X	X		
A.30.2.1.5.2.5			X	X		
A.30.2.1.6				X	X	
A.30.2.1.6.1				X	X	
A.30.2.1.6.2				X	X	
A.30.2.1.6.3				X	X	
A.30.2.1.6.4				X	X	
A.30.2.1.6.5				X	X	
A.30.2.1.7					X	
A.30.2.1.7.1					X	
A.30.2.1.7.2					X	
A.30.2.1.7.3					X	
A.30.2.1.7.4					X	
A.30.2.1.7.5					X	
A.30.2.1.7.6					X	
A.30.2.1.7.7					X	
A.30.2.1.7.8					X	
A.30.2.1.7.9					X	
A.30.2.1.7.10					X	
A.30.2.1.8.		X	X	X	X	
A.30.2.1.8.1			X	X		
A.30.2.1.8.2		X				
A.30.2.1.8.3			X	X		
A.30.2.1.8.4			X	X		
A.30.2.1.8.5			X	X	X	
A.30.3			X	X		
A.30.3.1			X	X		
A.30.3.2			X	X		

Table IV. Verification/Qualification Method						
REQUIREMENT	**N/A**	**EXAM**	**ANALYSIS**	**DEMO**	**TEST**	**CERT.**
A.30.3.3			X	X		
A.30.3.4			X	X		
A.30.3.4.1			X	X		
A.30.3.4.1.1			X	X		
A.30.3.4.1.1.1			X	X		
A.30.3.4.1.1.1.1			X	X		
A.30.3.4.1.1.1.1			X	X		
A.30.3.4.1.1.1.2			X	X		
A.30.3.4.1.1.1.3			X	X		
A.30.3.4.1.1.1.4			X	X		
A.30.3.4.1.1.2			X	X		
A.30.3.5			X	X		
A.30.4	X					
A.30.5	X					
A.30.6	X					
A.30.7	X					
A.30.7.1			X	X	X	
A.30.7.1.1			X	X		
A.30.7.1.2			X	X		
A.30.7.1.2.1			X	X		
A.30.7.1.3			X	X		
A.30.7.1.4			X	X		
A.30.7.1.4.1			X	X		
A.30.7.1.4.2			X	X		
A.30.7.1.4.3					X	
A.30.7.1.4.4			X	X		
A.30.7.1.4.5			X	X		
A.30.7.1.4.6			X	X		
A.30.7.1.5			X	X	X	
A.30.7.1.6			X	X		
A.30.7.2		X	X	X	X	
A.30.7.2.1			X		X	

Table IV. Verification/Qualification Method

REQUIREMENT	N/A	EXAM	ANALYSIS	DEMO	TEST	CERT.
A.30.7.2.2		X		X		
A.30.7.2.3		X	X	X	X	
A.30.7.3			X	X		
A.30.7.4			X	X		
A.30.7.4.1			X	X		
A.30.7.4.1.1			X	X		
A.30.7.4.1.1.1			X	X		
A.30.7.4.1.2			X	X		
A.30.7.4.1.2.1			X	X		
A.30.7.4.1.3				X		
A.30.7.4.2	X					
A.30.7.4.2.1				X		
A.30.7.4.2.1.1	X					
A.30.7.4.2.1.1.1			X	X		
A.30.7.4.2.1.1.2			X	X	X	
A.30.7.4.2.2				X		
A.30.7.4.2.3			X	X		
A.30.7.4.3			X	X		
A.30.7.4.3.1			X	X		
A.30.7.4.3.2			X	X		
A.30.7.4.3.3				X		
A.30.7.4.3.4			X	X	X	
A.30.7.4.3.5			X	X		
A.30.7.5			X	X		
F.30.1				X		
F.30.1.1	X					
F.30.1.1.1		X			X	
F.30.1.1.1.1		X		X		
F.30.1.1.1.2				X		
F.30.1.1.1.3		X				
F.30.1.1.2				X		
F.30.1.1.3				X	X	

Table IV. Verification/Qualification Method

REQUIREMENT	N/A	EXAM	ANALYSIS	DEMO	TEST	CERT.
F.30.1.1.4		X		X		
F.30.1.1.4.1		X		X		
F.30.1.1.4.2		X		X		
F.30.1.1.5		X		X		
F.30.1.2	X					
F.30.1.2.1				X		
F.30.1.2.2				X		
F.30.1.2.2.1				X		
F.30.1.2.2.1.1				X		
F.30.1.2.2.2		X		X		
F.30.1.2.2.3				X		
F.30.1.2.2.4			X	X		
F.30.1.2.2.5				X		
F.30.1.2.2.6			X	X		
F.30.1.2.2.7				X		
F.30.1.3	X					
F.30.1.4				X		
G.30.1		X		X	X	
G.30.1.1		X		X		
G.30.1.1.2		X		X	X	
G.30.1.1.3		X		X	X	
G.30.1.1.4		X		X	X	
G.30.1.1.5		X		X		
G.30.1.1.6		X	X	X	X	
G.30.1.1.7		X		X	X	
G.30.1.1.7.1		X		X		
G.30.1.1.7.2		X		X		
G.30.1.1.7.3		X		X		
G.30.1.1.7.4		X		X		
G.30.1.1.7.5		X		X		
G.30.1.1.7.6		X		X		
G.30.1.1.7.7		X		X		

Table IV. Verification/Qualification Method						
REQUIREMENT	**N/A**	**EXAM**	**ANALYSIS**	**DEMO**	**TEST**	**CERT.**
G.30.1.1.8		X		X		
G.30.1.1.9			X	X		
G.30.1.2		X	X	X		
G.30.1.2.1		X		X	X	
G.30.1.2.2		X		X	X	
G.30.1.2.3		X		X		
H.30.1		X		X	X	
H.30.1.1		X		X		
H.30.1.1.2		X		X	X	
H.30.1.1.3		X		X	X	
H.30.1.1.4	X					
H.30.1.1.4.1		X		X	X	
H.30.1.1.4.2		X		X	X	
H.30.1.1.5		X		X		
H.30.1.1.6		X	X	X	X	
H.30.1.1.7		X		X	X	
H.30.1.1.7.1		X		X		
H.30.1.1.7.2		X		X		
H.30.1.1.7.3		X		X		
H.30.1.1.7.4		X		X		
H.30.1.1.7.5		X		X		
H.30.1.1.7.6		X		X		
H.30.1.1.7.7		X		X		
H.30.1.1.8		X		X		
H.30.1.1.9			X	X		
H.30.1.2		X	X	X		
H.30.1.2.1		X		X	X	
H.30.1.2.2	X					
H.30.1.2.2.1		X		X	X	
H.30.1.2.2.2		X		X	X	
H.30.1.2.2.3		X		X	X	
H.30.1.2.2.4		X		X		

Table IV. Verification/Qualification Method						
REQUIREMENT	**N/A**	**EXAM**	**ANALYSIS**	**DEMO**	**TEST**	**CERT.**
H.30.1.2.2.5		X		X		
H.30.1.2.2.6		X		X		
H.30.1.2.3		X		X		
I.30.1		X		X	X	
I.30.1.1		X		X		
I.30.1.1.2		X		X	X	
I.30.1.1.3		X		X	X	
I.30.1.1.4	X					
I.30.1.1.4.1		X		X	X	
I.30.1.1.4.2		X		X	X	
I.30.1.1.5		X		X		
I.30.1.1.6		X	X	X	X	
I.30.1.1.7		X		X	X	
I.30.1.1.7.1		X		X		
I.30.1.1.7.2		X		X		
I.30.1.1.7.3		X		X		
I.30.1.1.7.4		X		X		
I.30.1.1.7.5		X		X		
I.30.1.1.7.6		X		X		
I.30.1.1.7.7		X		X		
I.30.1.1.8		X		X		
I.30.1.2		X	X	X		
I.30.1.2.1		X		X	X	
I.30.1.2.1.1		X		X	X	
I.30.1.2.1.2		X		X	X	
I.30.1.2.1.3		X		X	X	
I.30.1.2.1.4		X		X	X	
I.30.1.2.1.5		X		X	X	
I.30.1.2.1.6		X		X	X	
I.30.1.2.2		X		X		
J.30.1		X		X	X	
J.30.1.1		X		X		

Table IV. Verification/Qualification Method						
REQUIREMENT	**N/A**	**EXAM**	**ANALYSIS**	**DEMO**	**TEST**	**CERT.**
J.30.1.1.2		X		X	X	
J.30.1.1.3		X		X	X	
J.30.1.1.4	X					
J.30.1.1.4.1		X		X	X	
J.30.1.1.4.2		X		X	X	
J.30.1.1.5		X		X		
J.30.1.1.6		X	X	X	X	
J.30.1.1.7		X		X	X	
J.30.1.1.7.1		X		X		
J.30.1.1.7.2		X		X		
J.30.1.1.7.3		X		X		
J.30.1.1.7.4		X		X		
J.30.1.1.7.5		X		X		
J.30.1.1.7.6		X		X		
J.30.1.1.7.7		X		X		
J.30.1.1.8		X		X		
J.30.1.1.9			X	X		
J.30.1.2		X	X	X		
J.30.1.2.1		X		X	X	
J.30.1.2.2		X		X	X	
J.30.1.2.2.1		X		X	X	
J.30.1.2.2.2		X		X	X	
J.30.1.2.2.3		X		X	X	
J.30.1.2.2.4		X		X	X	
J.30.1.2.2.5		X		X	X	
J.30.1.2.2.6		X		X	X	
J.30.1.2.3		X		X		
K.30.1		X		X	X	
K.30.1.1		X		X		
K.30.1.1.2		X		X	X	
K.30.1.1.3		X		X	X	
K.30.1.1.4		X		X	X	

Table IV. Verification/Qualification Method						
REQUIREMENT	**N/A**	**EXAM**	**ANALYSIS**	**DEMO**	**TEST**	**CERT.**
K.30.1.1.5		X		X		
K.30.1.1.6		X	X	X	X	
K.30.1.1.7		X		X	X	
K.30.1.1.7.1		X		X		
K.30.1.1.7.2		X		X		
K.30.1.1.7.3		X		X		
K.30.1.1.7.4		X		X		
K.30.1.1.7.5		X		X		
K.30.1.1.7.6		X		X		
K.30.1.1.7.7		X		X		
K.30.1.1.8		X		X		
K.30.1.1.9			X	X		
K.30.1.2		X	X	X		
K.30.1.2.1		X		X	X	
K.30.1.2.2		X		X	X	
K.30.1.2.3		X		X	X	
K.30.1.2.4		X		X	X	
K.30.1.2.5		X		X	X	
K.30.1.2.6		X		X		
K.30.1.2.7		X		X		
L.30.1		X		X	X	
L.30.1.1		X		X		
L.30.1.1.2		X		X	X	
L.30.1.1.3	X					
L.30.1.1.4		X		X	X	
L.30.1.1.5		X		X		
L.30.1.1.6		X	X	X	X	
L.30.1.1.7		X		X	X	
L.30.1.1.7.1		X		X		
L.30.1.1.7.2		X		X		
L.30.1.1.7.3		X		X		
L.30.1.1.7.4		X		X		

Table IV. Verification/Qualification Method						
REQUIREMENT	**N/A**	**EXAM**	**ANALYSIS**	**DEMO**	**TEST**	**CERT.**
L.30.1.1.7.5		X		X		
L.30.1.1.7.6		X		X		
L.30.1.1.7.7		X		X		
L.30.1.1.8		X		X		
L.30.1.1.9			X	X		
L.30.1.2		X	X	X		
L.30.1.2.1		X		X		
L.30.1.2.1.1		X		X	X	
L.30.1.2.1.2		X		X	X	
L.30.1.2.1.2.1		X		X	X	
L.30.1.2.1.2.2		X		X	X	
L.30.1.2.1.2.2.1		X		X	X	
L.30.1.2.1.2.2.1.1		X		X	X	
L.30.1.2.1.2.2.1.2		X		X	X	
L.30.1.2.1.2.2.1.2.1		X		X	X	
L.30.1.2.1.2.2.1.2.2		X		X	X	
L.30.1.2.1.2.2.2		X		X	X	
L.30.1.2.1.2.2.3		X		X	X	
L.30.1.2.1.3		X		X	X	
L.30.1.2.2		X		X		

4.1.3 Ambient conditions.

Standard ambient conditions for room conditions at test facilities shall be as defined in paragraph 5.1(a) of MIL-STD-810.

4.1.4 Contractor-furnished inspection equipment.

4.1.4.1 Contractor design.

The contractor shall design and supply inspection equipment compatible with the ”Test Methods” requirements specified in 4.8 of this specification. Since tolerance of test equipment is considered normally within 10 percent of the product tolerance for which it is intended, this inherent error in the test equipment design must be considered as part of the prescribed product tolerance limit. Thus, concept, construction, materials, dimensions, and tolerances used in the design of test equipment shall be so selected and controlled as to ensure that the test equipment will indicate reliable acceptance of a product that does not exceed 90 percent of the prescribed tolerance limit and permit positive rejection when nonconforming. Construction shall be such as to facilitate routine calibration of the test equipment.

4.1.4.2 Testing facilities.

The contractor shall furnish any facilities, equipment or personnel that the Government may require to ensure that the CCTT components/modules meet the requirements of this specification. These facilities shall be capable of providing the specified operating environment and any other environmental condition required by any of the tests specified herein.

4.1.4.3 Test log.

The contractor shall maintain a log of all subsystem and system tests conducted in-plant and on-site. The log shall contain information by date, as to those equipments activated, maintenance performed including adjustments and alignments, equipment failure, redesign, and replacement. The contractor shall present the information in the log to help the Government technical representative determine that the maintenance, alignment or replacement has not invalidated previously completed tests. The log shall be made available to the Government technical representative immediately upon request.

4.2 Classification of inspections.

Pre-production lots will be subjected to the Prototype Inspection described in paragraph 4.3 and the packaging inspection in paragraph 4.7.

4.3 Prototype inspection conditions/qualifications methods.

4.3.1 Preproduction Qualification Test (PPQT).

A PPQT shall be performed to ensure that the CCTT equipment/components meet the requirements of Section 3 of the specification and Section 30s of Appendices A, and F through L. The CCTT system, for the purpose of conducting this test is defined as consisting of the following equipment/components:

FIXED CCTT	QUANTITY
M1A1 CPH Tank Module	6
M1A2 CPH Tank Module	4
M2A1/M3A2 CPH Module	6
Dismounted Infantry Module	2
FIST-V Module (M981)	1
APC Module (M113A3)	1
HMMWV Module	2
Operations Center	1
MCC Workstation	1
AAR Workstation	5
MC Workstation	1
SAF Workstations	10

MOBILE CCTT

Mobile Platoon Set-Tank:

M1A1 CPH Tank Module	4
Operations Center	1
MCC and AAR Workstation	1
SAF Workstations	2

Mobile Platoon Set-Fighting Vehicle:

M2A2/M3A2 CPH Module	4
Dismounted Infantry Module	1
Operations Center	1
MCC and AAR Workstation	1
SAF Workstations	2

The PPQT will consist of the following:

A. General inspection of table V

B. Qualification inspection of tables VI, VII, VIII, IX, X, XI, XII, XIII, and XIV.

4.3.2 QUICKSTART performance test.

The QUICKSTART modules (M1A1, M2A2/M3A2) requirements are common with Lot I requirements and all PPQT hardware and software corrections shall be integrated in the QUICKSTART modules.

4.4 Production Testing.

Production test shall be conducted as outlined in the Low Rate Initial Production (LRIP) Statement of Work (SOW).

4.4.1 Lot.

Deleted.

4.4.2 Inspection.

Deleted

4.4.3 Tests.

4.4.3.1 First article inspection (contractor).

Deleted

4.5 Quality conformance inspection.

4.5.1 Inspection.

Deleted

4.5.2 Group A inspection.

Deleted

4.6 Inspection comparison tests.

Deleted

4.7 Packaging inspection.

The inspection of the preservation and packaging, and interior package marking shall be in accordance with the requirements of MIL-A-83995. The inspection of the packing and marking for shipment shall be in accordance with the quality assurance provisions of the applicable container specification and marking requirements of MIL-STD-129.

Table V. General Inspection

DEFECT	REQUIREMENTS PARAGRAPH	INSPECTION CRITERIA
Safety	3.3.3	MIL-STD-454
Any Part of component missing or damaged	3.7 thru 3.8.5.4	MIL-STD-252
Finishes not protecting substrate (scratches, etc.)	Appendix B	MIL-STD-252
Improper Parts or materials	Appendix B	MIL-STD-252
Improper or absent marking or label	Appendix B	MIL-STD-252
Workmanship not as specified	Appendix B	MIL-STD-454
Color or finish incorrect	Appendix B	MIL-STD-252

Table VI. Qualification Inspection (contractor)

INSPECTION	REQUIREMENTS PARAGRAPH	TEST PARAGRAPH
System definitions	3.1	4.8.31
Training tasks	3.1.2	4.8.32
Interface definitions	3.1.3.1.1, 3.1.3.1.5, 3.1.3.2.1.1	4.8.33 - 4.8.33.3
System design	3.2	4.8.24
CCTT system performance	3.2.1	4.8.25
CCTT system standards	3.2.1.3	4.8.26
System latency	3.2.2.1 - 3.2.2.2	4.8.27
Dead reckoning algorithms	3.2.3	4.8.28
Design modularity	3.2.5	4.8.29
Model designs	3.2.5.1	4.8.29.1
Interoperability	3.2.1.1-3.2.1.2	4.8.16
Common Module Design Requirements	3.6-3.6.8	Tables VII-XIII (*)
Weight	3.2.7.1	4.19
Ceiling height	3.2.7.2	4.20
Equipment access	3.2.7.3	4.21
Trainer maintenance access	3.2.7.4	4.22
Power requirements	3.2.7.5-3.2.7.5.5 3.8.5-3.8.5.3	4.23
Equipment cooling	3.2.7.6	4.24
Console Lighting	3.2.7.7	4.25
Grounding	3.2.7.8-3.2.7.8.1	4.26
Cabling	3.2.7.10	4.27
Color	3.2.7.9	4.17.1
Reliability	3.2.8.1	4.13
Derating criteria	3.2.8.2	4.17.2
Maintainability	3.2.9 - 3.2.9.3.2	4.14 - 4.14.1
Environmental	3.2.10 - 3.2.10.5	4.9
Transportability	3.2.11	4.28 & 4.9
Materials, parts, processes	3.3.1	4.17
EMI	3.3.2.1 - 3.3.2.5	4.10 - 4.10.4

Table VI. Qualification Inspection (contractor)

INSPECTION	REQUIREMENTS PARAGRAPH	TEST PARAGRAPH
Safety	3.3.3 - 3.3.3.4	4.12
Human Factors Engineering	3.3.4	4.15
Personnel	3.5 - 3.5.2	4.8.30
OC	3.7.1	4.8.1
ALOC	3.7.1.1	4.8.2
TOC	3.7.1.2	4.8.3
CES	3.7.1.2.1	4.8.3.1
FSE	3.7.1.2.2	4.8.4
UMCP	3.7.1.3	4.8.5
FDC	3.7.1.4	4.8.6
FABTOC	3.7.1.5	4.8.7
TACP	3.7.1.6	4.8.8
Higher Headquarters Workstation	3.7.1.7	4.8.9
Control consoles	3.7.2	4.8.10
MCC	3.7.2.1	4.8.10 (a - e)
Start-up procedures	3.7.2.1.1	4.8.10, 4.8.10.1
Exercise control	3.7.2.1.2	4.8.10 (a - e)
Exercise initialization	3.7.2.1.2.1	4.8.10 (a - e)
Exercise modification	3.7.2.1.2.2	4.8.10 (a - e)
Exercise real-time intervention	3.7.2.1.2.3	4.8.10 (a - e)
Current status	3.7.2.1.3	4.8.10 (a - e)
MCC console printer	3.7.2.1.4	4.8.10j
AAR	3.7.2.2-3.7.2.2.8	4.8.10(f-i)
Trainer system processing	3.7.3	4.8.11
Computer system h/w requirements	3.7.3.1	4.8.11.1(a)
System composition	3.7.3.1.1	4.8.11.1(b)
Processor requirements	3.7.3.1.2	4.8.11.1
Maintenance console	3.7.2.3	4.8.11.1(d)
Peripherals	3.7.3.1.4	4.8.11.1(e)
Spare requirements	3.7.3.1.5	4.8.11.1(f)
Trainer system software	3.7.3.2 - 3.7.3.3.3	4.8.11.2

Table VI. Qualification Inspection (contractor)

INSPECTION	REQUIREMENTS PARAGRAPH	TEST PARAGRAPH
LAN	3.7.4 - 3.7.4.5	4.8.12
Visual System	3.7.5 and (App. A)	4.8.13 - 4.8.13.7.5
Communication System	3.7.6 - 3.7.6.3.1	4.8.14
SAF	3.7.7 and (App. F)	4.8.15 - 4.8.15.1.7

*** Applicable requirements for this section are referenced in the module table entries marked with an (*).**

Table VII. Qualification Inspection M1A1 module (contractor)

INSPECTION	REQUIREMENTS PARAGRAPH	TEST PARAGRAPH
M1A1 Module	H.30.1	*4.8.17
Performance Characteristics	H.30.1.1	4.8.17.1
Fire Control System	H.30.1.1.2	4.8.17.1.2
Weapons and Ammunition	H.30.1.1.3	4.8.17.1.3
Electrical System	H.30.1.1.4.1	4.8.17.1.4.1
Hydraulic System	H.30.1.1.4.2	4.8.17.1.4.2
Depletable Resource Management	H.30.1.1.5	4.8.17.1.5
Damage and Failure	H.30.1.1.6	4.8.17.1.6
Sound Generation System	H.30.1.1.7 - H.30.1.1.7.7	4.8.17.1.7
Communication System	H.30.1.1.8	4.8.17.1.8
Visual Display System	H.30.1.1.9	4.8.17.1.9
Physical Characteristics	H.30.1.2	4.8.17.2
Controls and Indicators	H.30.1.2.1 - H.30.1.2.2.6	4.8.17.2.1
External Interface Unit	H.30.1.2.3	4.8.17.2.2

Table VIII. Qualification Inspection M2A2/M3A2 module (contractor)

INSPECTION	REQUIREMENTS PARAGRAPH	TEST PARAGRAPH
M2A2/M3A2 Module	I.30.1	*4.8.18
Performance Characteristics	I.30.1.1	4.8.18.1
Fire Control System	I.30.1.1.2	4.8.18.1.2
Weapons and Ammunition	I.30.1.1.3	4.8.18.1.3
Electrical System	I.30.1.1.4.1	4.8.18.1.4.1
Hydraulic System	I.30.1.1.4.2	4.8.18.1.4.2
Depletable Resource Management	I.30.1.1.5	4.8.18.1.5
Damage and Failure	I.30.1.1.6	4.8.18.1.6
Sound Generation System	I.30.1.1.7- I.30.1.1.7.7	4.8.18.1.7
Communication System	I.30.1.1.8	4.8.18.1.8
Visual Display System	I.30.1.1.9	4.8.18.1.9
Physical Characteristics	I.30.1.2	4.8.18.2
Controls and Indicators	I.30.1.2.1- I.30.1.2.1.6	4.8.18.2.1
External Interface Unit	I.30.1.2.2	4.8.18.2.2

Table IX. Qualification Inspection DI module (contractor)

INSPECTION	REQUIREMENTS PARAGRAPH	TEST PARAGRAPH
Dismounted Infantry Module	3.7.10	*4.8.19
Physical characteristics	3.7.10.1 - 3.7.10.1.2	4.8.19.1
Performance characteristics	3.7.10.2	4.8.19.2
Weapons	3.7.10.2.1	4.8.19.2(a)
Movement	3.7.10.2.2	4.8.19.2(b)
Fire control system	3.7.10.2.3	4.8.19.2
Depletable resource management	3.7.10.2.4	4.8.19.2(d)
Controls and indicators	3.7.10.3-3.7.10.3.2	4.8.19.3
Visual display system	3.7.10.4	4.8.19.4
Communication system	3.7.10.5-3.7.10.5.1	4.8.19.5
Sound generation system	3.7.10.6-3.7.10.6.7	4.8.19.6

Table X. Qualification Inspection FIST-V module (contractor)

INSPECTION	REQUIREMENTS PARAGRAPH	TEST PARAGRAPH
FIST-V Module	K.30.1	*4.8.20
Performance Characteristics	K.30.1.1	4.8.20.1
Vehicle Weapons System	K.30.1.1.2	4.8.20.1.2
Weapons and Ammunition	K.30.1.1.3	4.8.20.1.3
Electrical System	K.30.1.1.4.1	4.8.20.1.4.1
Hydraulic System	K.30.1.1.4.2	4.8.20.1.4.2
Depletable Resource Management	K.30.1.1.5	4.8.20.1.5
Damage and Failure	K.30.1.1.6	4.8.20.1.6
Sound Generation System	K.30.1.1.7 - K.30.1.1.7.7	4.8.20.1.7
Communication System	K.30.1.1.8	4.8.20.1.8
Visual Display System	K.30.1.1.9	4.8.20.1.9
Physical Characteristics	K.30.1.2	4.8.20.2
Controls and indicators	K.30.1.2.1 - K.30.1.2.6	4.8.20.2.1
External Interface Unit	K.30.1.2.7	4.8.20.2.2

Table XI. Qualification Inspection M1A2 module (contractor)

INSPECTION	REQUIREMENTS PARAGRAPH	TEST PARAGRAPH
M1A2 Module	J.30.1	*4.8.21
Performance characteristics	J.30.1.1	4.8.21.1
Fire Control System	J.30.1.1.2	4.8.21.1.2
Weapons and Ammunition	J.30.1.1.3	4.8.21.1.3
Electrical system	J.30.1.1.4.1	4.8.21.1.4.1
Hydraulic system	J.30.1.1.4.2	4.8.21.1.4.2
Depletable Resource Management	J.30.1.1.5	4.8.21.1.5
Damage and Failure	J.30.1.1.6	4.8.21.1.6
Sound Generation System	J.30.1.1.7	4.8.21.1.7
Communication System	J.30.1.1.8	4.8.21.1.8

Table XI. Qualification Inspection M1A2 module (contractor)

INSPECTION	REQUIREMENTS PARAGRAPH	TEST PARAGRAPH
Visual display system	J.30.1.1.9	4.8.21.1.9
Physical characteristics	J.30.1.2	4.8.21.2
M1A2 Controls/Indicators	J.30.1.2.1 - J.30.1.2.2.6	4.8.21.2.1
External Interface Unit	J.30.1.2.3	4.8.21.2.2

Table XII. Qualification Inspection M113A3 APC module (contractor)

INSPECTION	REQUIREMENTS PARAGRAPH	TEST PARAGRAPH
M113A3 APC Module	G.30.1	*4.8.22
Performance Characteristics	G.30.1.1	4.8.22.1
Vehicle weapons system	G.30.1.1.2	4.8.22.1.2
Weapons and ammunition	G.30.1.1.3	4.8.22.1.3
Support Systems	G.30.1.1.4	4.8.22.1.4
Depletable Resource Management	G.30.1.1.5	4.8.22.1.5
Damage and Failures	G.30.1.1.6	4.8.22.1.6
Sound Generation System	G.30.1.1.7 - G.30.1.1.7.7	4.8.22.1.7
Communication System	G.30.1.1.8	4.8.22.1.8
Visual Display System	G.30.1.1.9	4.8.22.1.9
Physical Characteristics	G.30.1.2	4.8.22.2
Controls and Indicators	G.30.1.2.1 - G.30.1.2.2	4.8.22.2.1
External Interface Unit	G.30.1.2.3	4.8.22.2.2

Table XIII. Qualification Inspection HMMWV module (contractor)

INSPECTION	REQUIREMENTS PARAGRAPH	TEST PARAGRAPH
HMMWV Module	L.30.1	*4.8.23
Performance Characteristics	L.30.1.1	4.8.23.1
Vehicle Weapons System	L.30.1.1.2	4.8.23.1.2
Weapons and ammunition	L.30.1.1.3	4.8.23.1.3
Electrical Systems	L.30.1.1.4.1	4.8.23.1.4
Depletable Resource Management	L.30.1.1.5	4.8.23.1.5
Damage and Failure	L.30.1.1.6	4.8.23.1.6
Sound Generation System	L.30.1.1.7 - L.30.1.1.7.7	4.8.23.1.7
Communication System	L.30.1.1.8	4.8.23.1.8
Visual Display System	L.30.1.1.9	4.8.23.1.9
Physical Characteristics	L.30.1.2	4.8.23.2

Table XIII. Qualification Inspection HMMWV module (contractor)

INSPECTION	REQUIREMENTS PARAGRAPH	TEST PARAGRAPH
Controls and Indicators	L.30.1.2.1 - L30.1.2.1.3	4.8.23.2.1
External Interface Unit	L.30.1.2.2	4.8.23.2.2

Table XIV. Qualification Inspection mobile configuration (contractor)

INSPECTION	REQUIREMENTS PARAGRAPH	TEST PARAGRAPH
Mobile Configuration	3.8-3.8.5.3	4.18
Environmental conditions	3.8.2-3.8.2.2-3.8.3	4.18.1
Lightning protection	3.8.2.3	4.18.1.1
Semitrailers	3.8.4	4.18.2
Treatment, painting, identification	3.8.4.1	4.18.2.1
Color	3.8.4.2	4.18.2.2
Rustproofing	3.8.4.3	4.18.2.3
Hardwood	3.8.4.4	4.18.2.4
Wood hardwood	3.8.4.5	4.18.2.5
Weights, loads, dimensions	3.8.4.6-3.8.4.6.5	4.18.2.6-4.18.2.6.5
Performance	3.8.4.7-3.8.4.7.4	4.18.2.7
Brake performance	3.8.4.7.3,3.8.4.12	4.18.2.7.1
Slope and grade	3.8.4.7.4	4.18.2.7.2
Suspension system	3.8.4.8	4.18.2.8
Axles	3.8.4.9	4.18.2.9
Inner tubes, wheel and tire balancing	3.8.4.10-3.8.4.10.3	4.18.2.10
Rear wheel splash/stone	3.8.4.11	4.18.2.11
Brakes	3.8.4.12-3.8.4.12.2	4.18.2.12
Upper fifth wheel plate	3.8.4.13	4.18.2.13
Landing gear and leveling	3.8.4.14	4.18.2.14
Level indicators	3.8.4.15	4.18.2.15
Lifting and tiedown attach.	3.8.4.16	4.18.2.16
Rear end protection	3.8.4.17	4.18.2.17
Lubrication	3.8.4.18	4.18.2.18
Body construction	3.8.4.19-3.8.4.19.6	4.18.2.19
Side wall and roof framing	3.8.4.19.2	4.18.2.19.1
Front end	3.8.4.19.4	4.18.2.19.2
External doors/rear doors	3.8.4.19.5	4.18.2.19.3
Other external doors	3.8.4.19.5.2	4.18.2.19.4
Thermal protection	3.8.4.19.6	4.18.2.19.4

Table XIV. Qualification Inspection mobile configuration (contractor)

INSPECTION	REQUIREMENTS PARAGRAPH	TEST PARAGRAPH
Interior construction	3.8.4.20-3.8.4.20.4	4.18.2.20
Semitrailer lighting	3.8.4.21.1-3.8.4.21.1.3	4.18.2.21
12VDC system	3.8.4.21.1.1	4.18.2.21.1
Receptacle, 12VDC	3.8.4.21.1.2	4.18.2.21.2
Interconnected 24VDC	3.8.4.21.1.3	4.18.2.21.3
Receptacle, 24VDC	3.8.4.21.1.4	4.18.2.21.4
Interior lighting	3.8.4.21.2	4.18.2.21
External platforms, railings	3.8.4.22	4.18.2.22
Environmental Control system	3.8.4.23	4.18.2.23
Cooling units	3.8.4.23.1	4.18.2.23.1
Heating	3.8.4.23.2	4.18.2.23.2
Control circuits	3.8.4.23.3	4.18.2.23.3
Air filters	3.8.4.23.4	4.18.2.23.4
Maintainability	3.8.4.23.5	4.18.2.23.5
Humidity control	3.8.4.24	4.18.2.24
Fire extinguishers	3.8.4.25	4.18.2.25
Alarm system	3.8.4.26	4.18.2.26
Telephone system	3.8.4.27	4.18.2.27
Furniture and chairs	3.8.4.28	4.18.2.28
Provisions for maintenance	3.8.4.29	4.18.2.29
Provisions for storage	3.8.4.30	4.18.2.30
Electrical system	3.8.4.31-3.8.4.32	4.18.2.31
External panels and cables	3.8.4.32	4.18.2.32
Portable Power System	3.8.5-3.8.5.3	4.18.3

Table XV. Group A Inspection (contractor) - Deleted

INSPECTION	REQUIREMENTS PARAGRAPH	TEST PARAGRAPH
Deleted		

4.8 Test methods.

Tests shall be performed as stated herein. These tests are the minimum required to determine and assure conformance to each requirement of Sections 3 and 5 therein and to assure that the tests are properly conducted. The contractor shall use the qualification or verification inspection methods as defined in paragraph 4.1.2 to ensure compliance with the following characteristics.

4.8.1 Operations Center (OC)

The contractor shall verify the requirements of paragraph 3.7.1 by examination and demonstration.

4.8.2 Administrative Logistics Center (ALOC).

The contractor shall verify the requirements of paragraph 3.7.1.1 by analysis and demonstration. The analysis shall be done by examining the computer program routine to determine how the most tactically appropriate route for all dispatched vehicles is computed. The demonstration shall be done by conducting a training exercise that will allow the observation of how resources of ammunition and fuel are controlled from the CSS console. Requests for fuel and ammunition shall be made to the CSS console from vehicles located at different grid coordinates. The contractor shall demonstrate that the operator at the CSS console can dispatch up to sixteen (16) M978 HEMTT trucks for fuel and fifteen (15) M977 HEMTT trucks for ammunition to support the vehicles. The dispatched trucks shall be visible when traveling to the requested locations. They shall follow the HMMWV, as described in 3.7.14, and perform the operations of transfer of fuel or ammunition (depending on request) within a 200 meter radius. At all times, the visual perspective shall vary with respect to the range from the viewing vehicle. The CSS console shall display the current status of support vehicles showing what supplies and amount are available. The contractor shall also demonstrate that the supply trucks are vulnerable to combat damage, and susceptible to breakdowns.

4.8.3 Tactical operations center.

The contractor shall verify by demonstration that the TOC shall meet the requirements as specified in paragraph 3.7.1.2.

4.8.3.1 Combat engineering support

The contractor shall verify by demonstration that the CES console (3.7.1.2.1) provides to the operator the capabilities of emplacement of twenty minefields and obstacles and their destruction in real time, and that the movement on the current terrain data base is affected by the emplacement and destruction. Demonstrate that the CES console provides the capability to breach minefields and obstacles using dismounted infantry and the other equipment as specified in 3.7.1.2.1, and that the CES console provides control and movement of the M728 Combat Engineering Vehicle (CEV) and M9 Armored Combat Engineer Vehicle (ACE).

4.8.4 Fire support element.

The contractor shall demonstrate that the FSE console provides the capability for selection of type of weapon system, selection of targets to be engaged and value of target as specified in paragraph 3.7.1.2.2. Demonstrate that these capabilities can be coordinated with information received from the FABTOC and FIST-V.

4.8.5 Unit Maintenance Collection Point.

The contractor shall verify the requirements of paragraph 3.7.1.3 (UMCP) by analysis and demonstration. The analysis shall be done by examining the computer program routine to determine how the most tactically appropriate route for all dispatched vehicles is computed. The demonstration shall be done by conducting a training exercise (as in 4.8.2) that will allow the observation of how the repair and recovery of all combat vehicles is coordinated from this console. A request for repair and recovery shall be made to the console from combat vehicles located at different grid coordinates. The contractor shall demonstrate that the operator at the UMCP console can dispatch up to seven (7) M1083 MTV series 5 Ton trucks to support the requesting combat vehicles. The dispatched trucks/vehicles shall be visible when traveling to the requesting locations. They shall follow the HMMWV, as described in 3.7.1.4, and perform the operations of repair and recovery (depending on request) for vehicles within a 200 meter radius. The demonstration shall include the towing and retrieval of an unrepairable vehicle back to the UMCP.

4.8.6 Fire Direction Center (FDC).

The contractor shall verify the FDC requirements of paragraph 3.7.1.4 by analysis and demonstration. The analysis shall be done by examining the computer software to determine how the firing (considering the location and points of detonation) and movement times (considering realistic movement times) of the mortar platoons and vehicles is accomplished. The requirements shall be demonstrated by conducting a training exercise that will allow the observation of how the firing of the vehicles and mortars is computed and controlled from the FDC console. The exercise shall be as follows:

a. Initialize the FDC console and input grid coordinates for two M577A2 and six (6) M1064 mortar carriers.

b. Verify that the mortars can fire at the maximum sustained rate during the first minute and at a sustained rate thereafter consistent with the capabilities of the actual weapon. This shall be done at the minimum and maximum ranges of the mortar, and utilizing a high explosive shell for the two choices of fuze as defined in 3.7.1.4.

c. From the FDC console move any of the M1064 from the initial firing position, and while in transit, attempt to fire mortar rounds. Verify that the mortars are not capable of firing while in transit.

d. Verify that the operator at the FDC console can provide the missions as defined in paragraph 3.7.1.4 (a through f). These capabilities shall be verified while executing paragraph 4.8.6.b above.

e. Verify that while firing the weapons (b above) the effects of flashes relative to their locations of firing and flashes/explosions at points of detonation are displayed in the visual scene. The visual perspective shall vary with respect to the range from the viewing vehicle.

f. Verify the capability of the FDC to coordinate firing in real-time by performing a request for fire support from a requesting vehicle(s)/module(s) in the simulation to the FDC.

4.8.7 Field Artillery Battalion TOC.

The contractor shall verify the requirements of paragraph 3.7.1.5 by analysis and demonstration. The analysis shall be done by examining the computer software to determine how the firing (considering location and points of detonation) and movement times (realistic movement times) of the howitzers is accomplished. The analysis shall also examine the digital message capabilities. The contractor shall demonstrate that the FABTOC consoles provide FDC personnel with the capabilities as specified in paragraph 3.7.1.5 (a through h) by conducting an exercise that will allow the observation of how the firing of the howitzers is coordinated and controlled from the FABTOC console. The exercise shall be as follows:

a. Initialize the FABTOC console and input the grid coordinates for three batteries of eight (8) 155 mm self-propelled howitzers and one battery of (9) M270 Multiple Launch Rocket System (MLRS).

b. Verify that the howitzers can fire at a rate of 3 rounds per minute for the first 3 minutes and 1 round/minute thereafter. This shall be done at minimum and maximum ranges for the weapons, and utilizing a high explosive shell for the two choices of fuze as defined in paragraph 3.7.1.5. From the FABTOC console move any of the howitzers from the initial firing position and while in transit, attempt to fire the howitzers. Verify that the howitzers are not capable of firing while in transit.

c. Verify that while firing the weapons (4.8.7 a and b), the effects of flashes relative to their locations of firing and flashes/explosions at points of detonation are displayed in the visual scene. The visual perspective shall vary with respect to the range from the viewing vehicle.

d. Verify the capability of the FABTOC to coordinate firing in real-time by performing a request for fire support from a requesting vehicle(s)/module(s) in the simulation to the FABTOC.

4.8.8 Tactical Air Control Party (TACP).

The contractor shall verify the requirements of paragraph 3.7.1.6 by analysis and demonstration. The analysis shall be done through examination of the software to determine how the time for travel from airfield to strike area is computed. The requirement shall be demonstrated by conducting a training exercise that will allow the observation of how the types of close air support missions involving fixed wing aircraft, and the capabilities and displays as specified, are controlled from the TACP console. The requirement shall be demonstrated as follows:

a. The on-call support missions shall be verified by positioning two or three combat vehicles (M1A1, M2A2/M3A2, etc.) and targets in the battlefield (at different grid coordinates), and simulating through radio request from the combat vehicles, the air support mission(s).

b. The pre-planned support missions shall be verified with the same data as in (a) above but by designing the missions into different scenarios during scenario generation and before run-time of an scenario.

c. While performing the above air support missions, verify the effects of associated support displayed in the visual scene and that fixed wing aircraft are shown. Verify that the visual models emulated the actual aircraft in flight, weapons engagement, and evasive maneuvers.

d. Verify that while performing the air support missions, the operator has the capability to keep track of the status of all aircraft, stages of all missions planned, locations of all air support missions, description of targets, and the number of sorties for each mission.

4.8.9 Higher headquarters workstation.

The contractor shall verify the requirements of paragraph 3.7.1.7 by examination and demonstration. The workstation shall be examined to verify that it consist of three SINCGARS radio sets, a work surface, and a chair as specified. A training exercise shall be conducted to demonstrate that command and control, communications, and support communications are provided to the TOC.

4.8.10 Master Control Console (MCC) and After Action Review Console (AAR).

The contractor shall verify the requirements of paragraphs 3.7.2 through 3.7.2.2.8 by examination and demonstration. The examination shall consist of verifying that the MCC and AAR are provided with the capabilities and equipment as specified. The demonstration shall consist of operation of the MCC and AAR consoles to verify the required capabilities of paragraphs 3.7.2.1 through 3.7.2.2.8 and the following:

a. Demonstrate that the MCC console is provided with a security system that will prohibit unauthorized use, and show its capabilities.

b. Demonstrate that the MCC console is provided with a menu system that will allow for initialization of the CCTT system, perform BIT, provide status reporting of the CCTT system, and lead the operator to other functions as required.

c. Demonstrate that the console provides the operator the capability to develop, change, and select training exercises for use in CCTT. The capability to generate a new exercise, or copy and develop a derivative of an already existing exercise shall also be provided.

d. Demonstrate that the console has the capability to modify existing exercises, that provides the operator the capability to monitor and change any and all parameters of an exercise during real-time mode, and that the stored data file for that exercise is not affected.

e. Demonstrate that at all times the console provides to the operator the status of all equipment, modules, and supplies used in CCTT configuration.

f. Demonstrate that the AAR display console is comprised of a high resolution monitor with the characteristics and capabilities specified, and that the capabilities can be accomplished during real-time operation of the training exercises.

g. Demonstrate that the AAR console can store and replay complete training scenarios with the additional capabilities of paragraph 3.7.2.2.4.

h. Demonstrate that the AAR console is provided with the capability of automatic data collection as specified in paragraph 3.7.2.2.6 and that after completion of a training exercise, the performance data is provided in hard copy format and in a statistical format. The data collected shall include the details as specified in paragraph 3.7.2.2.6 and shall be recorded, displayed and/or printed as requested from the AAR console through the use of menus.

i. Demonstrate that the AAR console provides the capabilities of recording all radio communication traffic for the selected exercise. The console shall be examined to verify that it consists of at least four loudspeakers with capabilities as specified.

j. Verify that the MCC and MC stations provide the capabilities specified in paragraph 3.7.2.1.4.

4.8.10.1 Initialization

The contractor shall demonstrate the requirements for initialization of the CCTT system (3.7.2.1.1) as follows: The controlling operator shall initialize the CCTT system from the MCC console and shall input all data necessary for starting a training session. The initialization procedures shall be timed to verify that they will not require more than fifteen (15) minutes of the operator's time for execution. The contractor shall demonstrate throughout the training session that when a module finishes the required start-up procedures (including BIT), a message is sent automatically to the MCC console indicating that the individual modules are up and ready for the exercise. The contractor shall demonstrate the identification of individual modules on the LAN by introducing the individual module "identifiers" into the CCTT system during the start-up procedures for a particular exercise.

4.8.11 Trainer System Processing Resource (TSPR).

The TSPR shall be examined to verify that it is comprised of one group of trainer system processing resources to perform the workstation/console functions, and another group of trainer system processing resources for the simulation modules specified in paragraph 3.7.3.

4.8.11.1 Trainer System Hardware Resource (TSHR).

The Trainer System Hardware Resources shall be verified as follows:

a. Verify by certifications that the requirements of paragraph 3.7.3.1 has been met.

b. Verify by examinations that the requirements of paragraph 3.7.3.1.1 has been met.

c. Processor requirements. The contractor shall demonstrate and verify through analysis that each processor meets the system performance requirements (3.7.3.1.2) herein and that all displays are free of stepping, oscillating, jittering, or other erratic behavior. Demonstrate that the memory for each processor is sufficient and also meet the spare memory requirements of paragraph 3.7.3.1.5. The contractor shall demonstrate that communication between processors and other systems is possible meeting the speed, channel capacity, and spare requirements as specified.

d. Verify by examination the physical characteristics and demonstrate the required capabilities of the maintenance console as required by paragraph 3.7.2.3.

e. Verify by certification and demonstration that the peripheral equipment provided with the computer system meets the requirements as specified in paragraph 3.7.3.1.4.

f. Spare requirements. The contractor shall demonstrate the requirements of spare memory, spare disk, spare processing time, and spare input/output capacity as specified in paragraph 3.7.3.1.5.

4.8.11.2 Trainer system software.

The trainer software requirements shall be verified as follows:

a. Verify by analysis, examination and demonstration that the system software provided for the trainer meets the requirements as specified in paragraphs 3.7.3.2-3.7.3.2.1.1.

b. The software components shall be verified by analysis and examination to determine that the requirements of paragraph 3.7.3.2.2(a) have been met.

c. Verify by certification that the operating system software and application programs for the computer meet the requirements of paragraph 3.7.3.2.2(b).

d. The diagnostic software provided for the computer system shall be verified by certification and demonstration. The demonstration will consist of inserting random failures (to be selected by the Government) into the computers and peripheral equipment to determine the capabilities of the computer diagnostic programs and system daily readiness check program as specified in paragraph 3.7.3.2.2.

e. Verify by examination that the trainer system software (TSS) consists of the computer software configuration items (CSCI) with the characteristics and capabilities as specified in paragraph 3.7.3.2.3. Each computer software configuration item (CSCI) shall be verified by certification, examination, and tests to determine that the requirements have been met.

f. The contractor shall verify by analysis and demonstration that the requirements for the TSSE as specified in paragraphs 3.7.3.3 through 3.7.3.3.3 have been met.

g. Verify by examination and demonstration that the TSSE computer hardware meets the requirements as specified in paragraph 3.7.3.3.1.

h. Verify by analysis, examination and demonstration that the TSSE software including firmware meets the requirements as specified in paragraphs 3.7.3.3.2 and 3.7.3.3.3. The examination will verify that the TSSE software and CASE tools include the equipment as described therein. The analysis and demonstration will verify performance requirements.

i. Deleted.

4.8.12 LAN.

The capabilities of the LAN (3.7.4-3.7.4.5 and 3.2.5) shall be demonstrated by the successful completion of situational training exercises conducted individually and simultaneously, on terrain and environment selected by the Government, and using the maximum module capability that the network can hold. Requirement verification shall be accomplished through examination and analysis.

4.8.13 Visual System.

The visual system for the CCTT shall be inspected and tested to verify that the requirements as described in Section 3 and Appendix A have been satisfied. The contractor shall supply all test equipment necessary to accomplish the inspections and tests specified herein. Requirements to be verified through demonstration will utilize collective tasks selected from the List of the Army Training Evaluation Program (ARTEP) Mission Training Plans (MTP).

The capabilities and characteristics of the visual system shall be verified by analysis and demonstration to determine that the requirements of 3.7.5, G.30.1.1.9, H.30.1.1.9, I.30.1.1.9, J.30.1.1.9, K.30.1.1.9 and L.30.1.1.9 have been met. The interface between the host computer and visual image system shall be examined to verify clean separation of functions as specified in A.30.1.1.

4.8.13.1 Mechanical Interface

The mechanical interface of the visual system (A.30.1.1.1) shall be examined to verify properly position and structural support of the components of the visual display system.

4.8.13.2 Electronic Interface

The contractor shall verify through examination and demonstration that the electronic interface requirements (A.30.1.1.2) have been met.

4.8.13.3 Software interface

The contractor shall verify through examination and demonstration that the software interface of the visual system (A.30.1.1.3) have been met.

4.8.13.4 Major components

The visual system shall be demonstrated to verify that it consists of the specified components (A.30.1.2.1 - A.30.1.2.5).

4.8.13.5 Performance

The contractor shall verify through demonstration and testing that the visual system can support the specified CCTT performance requirements A.30.2.1. The contractor shall verify through demonstration and testing that the visual system can support the specified CCTT functional training capabilities (A.30.2.1.1 through A.30.2.1.1.2.7). The demonstration shall include the capability of mission practice for all types of operational missions for the full range of battle and environment conditions.

4.8.13.5.1 Not Used

4.8.13.5.2 General training scene requirements

The contractor shall verify through demonstration and testing that the specified training scene requirements and capabilities (A.30.2.1.1.2 through A.30.2.1.1.2.3) have been adequately provided for all visual displays.

4.8.13.5.3 General training scene requirements (Ground)

The contractor shall verify through demonstration that the specified training scene requirements and capabilities (A.30.2.1.1.2.4 through A.30.2.1.1.2.7) have been adequately provided for all visual displays.

4.8.13.6 Special real-time processing

The contractor shall verify through demonstration, analysis and testing that the specified special real-time processing environmental conditions and effects requirements (A.30.2.1.2 through A.30.2.1.2.5.3) have been adequately simulated.

4.8.13.6.1 Atmospheric and meteorological effects

The contractor shall verify through test and demonstration that the atmospheric and meteorological effects requirements (A.30.2.1.2.1) have been adequately provided.

4.8.13.6.1.1 Ambient visibility (haze)

The contractor shall verify through demonstration and test that the specified ambient visibility (haze) requirements (A.30.2.1.2.1.1) have been adequately provided. The nominal visibility for the haze shall be examined and verified to be adjustable to the range and increments specified.

4.8.13.6.1.2 Fog simulation

The contractor shall verify through demonstration and test that the specified fog simulation requirements (A.30.2.1.2.1.2) have been adequately provided. The fog density shall be examined and verified to be adjustable to the range and increments specified.

4.8.13.6.1.3 Cloud simulation

The contractor shall verify through demonstration and test that the specified cloud simulation requirements (A.30.2.1.2.1.3) have been adequately provided. The ceiling height shall be examined and verified of being set to the range and increments specified.

4.8.13.6.1.4 Rain simulation

The contractor shall verify through demonstration that the specified rain simulation requirements (A.30.2.1.2.1.4) have been adequately provided.

4.8.13.6.1.5 Sky and horizon

The contractor shall verify through demonstration that the colors and brightness requirements for the sky and horizon (A.30.2.1.2.1.6) have been adequately provided.

4.8.13.6.2 Illumination

The contractor shall verify through demonstration that the illumination of the visual scene requirements (A.30.2.1.2.2) have been adequately provided.

4.8.13.6.3 Time of day

The time of day requirements of A.30.2.1.2.2.1 shall be verified by loading a database consisting of terrain faces, culture layers, natural objects, moving models, and weapons effects. Day, overcast day, dawn/dusk, moonlit night and starlit night, and the additional levels for night illumination shall be performed to demonstrate the effects of brightness, coloring, contrast, intensity and shading variations.

4.8.13.6.4 Artificial illumination.

4.8.13.6.4.1 Flare illumination

The flare capability provided by the visual system shall be demonstrated to verify conformance with the flare illumination requirements of A.30.2.1.2.2.2.1. The illumination round for the 120mm mortar and the M485A2 illumination round for the 155mm Howitzer types of flares shall be demonstrated.

4.8.13.6.4.2 Light points

The requirements for light points shall be demonstrated to verify conformance with the specifications paragraph A.30.2.1.2.2.2.2.

4.8.13.6.4.3 Light point intensity control

The requirements for light point intensity control shall be demonstrated to verify conformance with the specifications paragraph A.30.2.1.2.2.2.3.

4.8.13.6.5 Tactical smoke

The requirements for smoke effects shall be demonstrated to verify conformance with the requirements A.30.2.1.2.3 of this specification.

4.8.13.6.6 Own-vehicle dynamics

The requirements for own-vehicle dynamics shall be demonstrated to verify conformance with the specifications paragraph A.30.2.1.2.4.1.

4.8.13.6.7 Moving/repositioning/switchable models

The requirements for the moving/repositionable/switchable models shall be demonstrated, tested, and analyzed to verify conformance with the specification paragraph A.30.2.1.2.4.2.

4.8.13.6.8 Animation and special effects

4.8.13.6.8.1 Propeller/Rotor disc

The requirement for the propeller/rotor disc shall be demonstrated to verify conformance with the specification paragraph A.30.2.1.2.4.3.1.

4.8.13.6.8.2 Visible weapons effects

The requirements for the visible weapons effect shall be demonstrated to verify the conformance with the specification paragraph A.30.2.1.2.4.3.2.

4.8.13.6.8.3 Air-to-ground weapon effects

The requirements for the air-to-ground weapons effects shall be demonstrated to verify compliance with the specification paragraph A.30.2.1.2.4.3.2.1.

4.8.13.6.8.4 Weapons fire and weapons impact effect

The requirements for weapons fire and weapons impact effects shall be demonstrated to verify conformance with A.30.2.1.2.4.3.2.2 of this specification.

4.8.13.6.8.5 Tracer simulation

The requirements for tracer simulation shall be demonstrated to verify conformance with A.30.2.1.2.4.3.2.2.1 of this specification.

4.8.13.6.8.6 Dust trail

The requirements for dust trail simulation shall be demonstrated to verify conformance with A.30.2.1.2.4.3.3 of this specification.

4.8.13.6.8.7 Simulated position

The requirement for simulated position shall be tested and analyzed to verify conformance with paragraph A.30.2.1.2.5.1 of the specifications.

4.8.13.6.8.8 Visual environment feedback

The requirements for visual environment feedback shall be demonstrated, tested and analyzed to verify conformance with paragraph A.30.2.1.2.5.2 of the specifications.

4.8.13.6.8.9 Surface contact and soil type

The requirements for surface contact and soil type shall be demonstrated, tested, and analyzed to verify conformance with paragraph A.30.2.1.2.5.2.1 of the specifications.

4.8.13.6.8.10 Collision detection

The requirements for collision detection shall be demonstrated, tested, analyzed to verify conformance with paragraph A.30.2.1.2.5.2.2 of the specifications.

4.8.13.6.8.11 Weapon impact detection

The requirements for weapon impact detection shall be demonstrated to verify conformance with paragraph A.30.2.1.2.5.2.3 of the specifications.

4.8.13.6.8.12 Laser range finder

The requirements for the laser range finder shall be demonstrated and tested to verify conformance with paragraph A.30.2.1.2.5.2.4 of the specifications.

4.8.13.6.8.13 Line of sight

The requirements for line of sight shall be demonstrated and tested to verify conformance with paragraph A.30.2.1.2.5.2.5 of the specification.

4.8.13.6.8.14 Gaming area

The requirements for gaming area shall be demonstrated and tested to verify conformance with paragraph A.30.2.1.2.5.3 of the specifications.

4.8.13.6.9 Image quality, general

The image quality requirements of A.30.2.1.3 shall be demonstrated and tested to verify conformance with the requirements. The complete trainer with integrated visual system shall provide the performance specified below:

4.8.13.6.9.1 Visual image sharpness

The visual image sharpness of the displayed image shall be tested for conformance with the requirements of paragraph A.30.2.1.3.2 of the specifications.

4.8.13.6.9.2 Surface resolution

The surface resolution requirements shall be tested to verify conformance with paragraph A.30.2.1.3.2.1 of the specifications.

4.8.13.6.9.3 Light point resolution

The light point resolution shall be tested to verify conformance with paragraph A.30.2.1.3.2.2 of the specifications.

4.8.13.6.9.4 Luminance

The luminance requirements shall be tested to verify conformance with paragraph A.30.2.1.3.3 of the specifications.

4.8.13.6.9.5 Luminance variation

The luminance variation shall be tested to verify conformance with paragraph A.30.2.1.3.3.1 of the specifications.

4.8.13.6.9.6 Contrast

The contrast ratio shall be tested for each displayed image and shall be no less than the values indicated in specification paragraph A.30.2.1.3.4.

4.8.13.6.9.7 Color

The visual system imagery shall be demonstrated and tested to verify conformance with the color requirements of paragraph A.30.2.1.3.5 of the specifications.

4.8.13.6.9.7.1 Color processing

The color processing shall be tested to verify conformance with the requirements of the specification paragraph A.30.2.1.3.5.1.

4.8.13.6.9.7.2 Color registration

The color registration shall be tested to verify conformance with the specification paragraph A.30.2.1.3.5.2.

4.8.13.6.9.8 Image perspective and geometric accuracy

The image perspective and geometric accuracy shall be tested to verify conformance with the requirements of A.30.2.1.3.6 of the specifications.

4.8.13.6.9.8.1 Total geometric accuracy

The geometric accuracy shall be tested to verify conformance with the specification paragraph A.30.2.1.3.6.1.

4.8.13.6.9.8.2 Relative geometric accuracy

The relative geometric errors shall be tested to verify conformance with the specification paragraph A.30.2.1.3.6.2.

4.8.13.6.9.9 Vernier resolution

The vernier resolution for each display shall be tested to verify conformance with the requirements A.30.2.1.3.7 of the specifications.

4.8.13.6.9.10 Adjacent channel matching

The adjacent channel matching shall be tested to verify conformance with the specification paragraph A.30.2.1.3.8.

4.8.13.6.9.11 Image stability

The image stability for each displayed image shall be tested and demonstrated to verify conformance with the requirements of paragraph A.30.2.1.3.9 of the specifications.

4.8.13.6.9.12 Video rate

The video rates shall be tested to verify conformance with the specification paragraph A.30.2.1.3.10.

4.8.13.6.9.13 Update rate

The update rate shall be tested to verify conformance with the specification paragraph A.30.2.1.3.11.

4.8.13.6.9.14 Transport delay

The transport delay requirements shall be analyzed and tested to verify conformance with the requirement A.30.2.1.3.12 of the specifications.

4.8.13.6.9.15 Occulting

The occulting or hidden surface elimination shall be demonstrated to verify conformance with the requirements of the specification paragraph A.30.2.1.3.13.

4.8.13.6.9.16 Smear

The smear requirements due to image motion shall be demonstrated to verify conformance with the specification paragraph A.30.2.1.3.14.

4.8.13.6.9.17 Flicker

The flicker requirements due to image refresh shall be demonstrated to verify conformance with the specification paragraph A.30.2.1.3.15.

4.8.13.6.9.18 Stepping

The stepping requirements shall be demonstrated to verify conformance with the specification paragraph A.30.2.1.3.16.

4.8.13.6.10 Image quality (system capacity)

The image quantity (system capacity) shall be analyzed, tested and demonstrated to verify conformance with the specification paragraph A.30.2.1.5.

4.8.13.6.10.1 Continuous image intensity

The continuous Image density shall be analyzed, tested and demonstrated to verify conformance with the specification paragraph A.30.2.1.5.1.

4.8.13.6.10.1.1 Feature selection

The feature selection shall be analyzed and demonstrated to verify the specification paragraph A.30.2.1.5.1.1.

4.8.13.6.10.2 Scene content management

The scene content management shall be analyzed and demonstrated to verify conformance with the specification paragraph A.30.2.1.5.2.

4.8.13.6.10.2.1 Scene management mechanisms

The scene management mechanism shall be analyzed and demonstrated to verify conformance with the specification paragraph A.30.2.1.5.2.1.

4.8.13.6.10.2.2 Environment integrity

The environment integrity shall be analyzed and demonstrated to verify conformance with the specification paragraph A.30.2.1.5.2.2.

4.8.13.6.10.2.3 Scene management dynamics

The scene management dynamics shall be analyzed and demonstrated to verify conformance with the specification paragraph A.30.2.1.5.2.3.

4.8.13.6.10.2.4 Scene management strategy variations

Deleted

4.8.13.6.10.2.5 Overload prevention

The overload prevention shall be analyzed and demonstrated to verify conformance with the specification paragraph A.30.2.1.5.2.5.

4.8.13.6.11 Display configurations

The display configuration requirements shall be tested and demonstrated to verify conformance with the specification paragraph A.30.2.1.6. The testing of an attitude sensor, e.g, head tracker, will be done as part of the entire visual system test and again as part of the entire module system test.

4.8.13.6.11.1 Full circle vision block configurations

The full circle periscope mosaics shall be tested and demonstrated to verify conformance with the specification paragraph A.30.2.1.6.1.

4.8.13.6.11.2 Popped hatch displays

The popped hatch displays shall be tested and demonstrated to verify conformance with the specification paragraph A.30.2.1.6.2.

4.8.13.6.11.3 Driver displays

The driver displays shall be tested and demonstrated to verify conformance with the specification paragraph A.30.2.1.6.3.

4.8.13.6.11.4 Loader displays

The loader displays shall be tested and demonstrated to verify conformance with the specification paragraph A.30.2.1.6.4.

4.8.13.6.11.5 Sights (primary, backup, and extension, (optical and thermal))

The gunners primary sight and extension shall be tested and demonstrated to verify conformance with the specification paragraph A.30.2.1.6.5.

4.8.13.6.11.6 After action review console - visual display

Deleted

4.8.13.6.11.7 After action review - debrief display

Deleted

4.8.13.6.11.8 Tactical air control party console - visual display

Deleted

4.8.13.6.11.9 High mobility multipurpose wheeled vehicle (HMMWV) module

Deleted

4.8.13.6.11.10 Dismounted Infantry (DI) module

Deleted

4.8.13.6.12 Module/Console specific FOV and resolution requirements

The Module/Console specific FOV and resolution requirements shall be tested to verify conformance with the specification paragraph A.30.2.1.7.

4.8.13.6.12.1 M1A1/M1A2 tank module

The M1A1/M1A2 tank visual displays shall be tested to verify conformance with the specification paragraph A.30.2.1.7.1.

4.8.13.6.12.2 M2A2 Infantry fighting vehicle and M3A2 cavalry fighting vehicle module

The M2A2 Bradley Fighting Vehicle and the M3A2 Cavalry Fighting Vehicle visual displays shall be tested to verify conformance with the specification paragraph A.30.2.1.7.2.

4.8.13.6.12.3 M981 fire support team vehicle module (FIST-V)

The M981 Fire Support Team Vehicle visual displays shall be tested to verify conformance with the specification paragraph A.30.2.1.7.3.

4.8.13.6.12.4 Not Used

4.8.13.6.12.5 M113A3 armored personnel carrier (APC)

The M113 Armored Personnel Carrier visual displays shall be tested to verify conformance with the specification paragraph A.30.2.1.7.5.

4.8.13.6.12.6 High mobility multipurpose wheeled vehicle (HMMWV) module

The HMMWV visual displays shall be tested to verify conformance with specification paragraph A.30.2.1.7.6.

4.8.13.6.12.7 Dismounted infantry (DI) module

The Dismounted Infantry (DI) visual displays shall be tested to verify conformance with specification paragraph A.30.2.1.7.7.

4.8.13.6.12.8 After action review console - visual display

The AAR console visual displays shall be tested to verify conformance to the specification paragraph A.30.2.1.7.8.

4.8.13.6.12.9 After action review - debrief display

The AAR debrief display requirements shall be tested to verify conformance to the specification paragraph A.30.2.1.7.9.

4.8.13.6.12.10 Tactical Air Control Party console - visual display

The TACP visual display shall be tested and demonstrated to verify conformance with the specification paragraph A.30.2.1.7.10.

4.8.13.6.12.11 Electro-optics sensor image simulation

The Electro-optics sensor image simulation for the presence of the components as described in the specification paragraph A.30.2.1.8 shall be examined, analyzed, demonstrated and tested.

4.8.13.6.12.11.1 Sensor image database

The Sensor Image Database shall be demonstrated and analyzed to verify conformance with the specification paragraph A.30.2.1.8.1.

4.8.13.6.12.11.2 Thermal sight image simulation

The thermal sight image simulation shall be analyzed and demonstrated to verify conformance with the specification paragraph A.30.2.1.8.3.

4.8.13.6.12.11.3 Night vision image intensifier

Night vision image intensification simulation shall be analyzed and demonstrated to verify compliance with the specification paragraph A.30.2.1.8.4.

4.8.13.6.12.11.4 Laser range finder

Laser range finder simulation shall be analyzed, demonstrated and tested to verify the requirements of the specification paragraph A.30.2.1.8.5.

4.8.13.6.13 Design requirements

The contractor shall verify through analysis and demonstration that the specified design requirements (A.30.3 through A.30.3.5) have been adequately simulated.

4.8.13.7 Major Components Characteristics.

4.8.13.7.1 Image generator subsystem

The Image Generator Subsystem shall be analyzed, demonstrated and tested to verify conformance with the specification paragraph A.30.7.1.

4.8.13.7.1.1 Image generation system throughput

The Image Generation System throughput shall be demonstrated and analyzed to verify conformance with the specification paragraph A.30.7.1.1.

4.8.13.7.1.2 Display image artifacts

The Displayed Image Artifacts shall be demonstrated and analyzed to verify compliance with the specification paragraph A.30.7.1.2.

4.8.13.7.1.2.1 Anti-aliasing

The Anti-Aliasing shall be demonstrated and analyzed to verify compliance with the specification paragraph A.30.7.1.2.1.

4.8.13.7.1.3 Special image generator processing

The Special Image Generator Processing shall be demonstrated and analyzed to verify compliance with the specification paragraph A.30.7.1.3.

4.8.13.7.1.4 Texture

Mapping of image data onto environment polygons shall be demonstrated and analyzed to verify conformance with the specification paragraph A.30.7.1.4.

4.8.13.7.1.4.1 Mapping

Image data mapping shall be demonstrated and analyzed to verify conformance with the specification paragraph A.30.7.1.4.1.

4.8.13.7.1.4.2 Anti-aliasing and blending

Image data anti-aliasing and blending shall be demonstrated and analyzed to verify conformance with the specification paragraph A.30.7.1.4.2.

4.8.13.7.1.4.3 Image data quantity

Image data storage shall be tested to verify conformance with the specification paragraph A.30.7.1.4.3.

4.8.13.7.1.4.4 Image data retrieval

The Image Data Retrieval shall be demonstrated and analyzed to verify conformance with the specification paragraph A.30.7.1.4.4.

4.8.13.7.1.4.5 Dynamic texture

Dynamic texture patterns shall be demonstrated and analyzed to verify conformance with the specification paragraph A.30.7.1.4.5.

4.8.13.7.1.4.6 Improved texture performance

Deleted

4.8.13.7.1.5 Database storage capacity

The Database storage capacity shall be demonstrated, analyzed and tested to verify conformance with specification paragraph A.30.7.1.5.

4.8.13.7.1.6 Improved IG performance

The potential for Improved IG performance shall be demonstrated, and analyzed to verify conformance with specification paragraph A.30.7.1.6.

4.8.13.7.2 Image display subsystem

The Image Displays Subsystem shall be examined, demonstrated, analyzed and tested to verify conformance with the specification paragraph A.30.7.2.

4.8.13.7.2.1 Viewing volume and viewing distance

Deleted

4.8.13.7.2.2 Optics

Optics shall be examined and demonstrated to verify conformance with the specification paragraph A.30.7.2.2.

4.8.13.7.2.3 Magnified displays

The Magnified Sight Displays shall be examined, demonstrated, analyzed and tested to verify conformance with the specification paragraph A.30.7.2.3.

4.8.13.7.3 Image database development system

The Image Data Base Development System shall be demonstrated and analyzed to verify conformance with the specification paragraph A.30.7.3 (a through n).

4.8.13.7.4 Visual and sensor image database

The Visual and Sensor Image Database shall be demonstrated and analyzed to verify conformance with the specification paragraph A.30.7.4.

4.8.13.7.4.1 Deliverable training requirements

Deliverable Training Environments shall be demonstrated and analyzed tested to verify conformance with the specification paragraph A.30.7.4.1.

4.8.13.7.4.1.1 Primary environments

The Primary Environments shall be demonstrated and analyzed to verify conformance with the specification paragraph A.30.7.4.1.1.

4.8.13.7.4.1.1.1 Database source data

Database Source Data shall be demonstrated and analyzed to verify conformance with the specification paragraph A.30.7.4.1.1.1.

4.8.13.7.4.1.2 Secondary environment

The Secondary Environment shall be demonstrated and analyzed to verify compliance with the specification paragraph A.30.7.4.1.2.

4.8.13.7.4.1.2.1 Database source data

The Secondary Environment shall be demonstrated and analyzed to verify compliance with the specification paragraph A.30.7.4.1.2.1.

4.8.13.7.4.1.3 Deliverable general use models

For the primary environments the Deliverable General Use Models listed in table A-1 shall be demonstrated to verify conformance with the specification paragraph A.30.7.4.1.3. For the secondary environments the Moving Models of the corresponding database shall be demonstrated to verify conformance with the specification paragraph A.30.7.4.1.3.

4.8.13.7.4.2 Detailed training environment and model requirements

4.8.13.7.4.2.1 Training environments

The Training Environments shall be demonstrated to verify conformance with the specification paragraph A.30.7.4.2.1.

4.8.13.7.4.2.1.1 Feature models for real world

Feature models for real world shall be demonstrated and analyzed to verify conformance with the specification paragraph A.30.7.4.2.1.1.1.

4.8.13.7.4.2.1.2 Real world feature capture criteria

Real world feature capture criteria shall be demonstrated, analyzed and tested to verify conformance with the specification paragraph A.30.7.4.2.1.1.2.

4.8.13.7.4.2.2 Library models

Library Models shall be demonstrated to verify conformance with the specification paragraph A.30.7.4.2.2.

4.8.13.7.4.2.3 General use models

General Use Models shall be demonstrated and analyzed to verify compliance with the specification paragraph A.30.7.4.2.3.

4.8.13.7.4.3 General database requirements

General Data Base Requirements shall be demonstrated and analyzed to verify conformance with the specification paragraph A.30.7.4.3.

4.8.13.7.4.3.1 Application specific design

Application Specific Design shall be demonstrated and analyzed to verify compliance with the specification paragraph A.30.7.4.3.1.

4.8.13.7.4.3.2 Use of image data and texture

The Use of Image and Texture shall be demonstrated and analyzed to verify compliance with the specification paragraph A.30.7.4.3.2.

4.8.13.7.4.3.3 General scene data

General Scene Detail shall be demonstrated to verify compliance with the specification paragraph A.30.7.4.3.3.

4.8.13.7.4.3.4 Generic fill-in and scene enrichment

Generic Fill-in and Scene Enrichment shall be demonstrated, analyzed and tested to verify compliance with the specification paragraph A.30.7.4.3.4.

4.8.13.7.4.3.5 Database compatibility

Data Base Compatibility shall be demonstrated and analyzed to verify compliance with the specification paragraph A.30.7.4.3.5.

4.8.13.7.5 Operating and maintenance software and hardware

Operating and maintenance software and hardware shall be demonstrated and analyzed to verify compliance with the specification paragraph A.30.7.5.

4.8.14 Communication System.

The communication system and its capabilities shall be verified by test. This shall be done by conducting training exercises and using the communication equipment provided with each module and console, where communication monitoring and external communication (module-to-module, and module-to-OC) can be performed. The contractor shall demonstrate that the radio configurations replicates the new SINCGARS series of radio, and that the communication system provides the required elements and configurations as specified in 3.7.6.

4.8.15 SAF.

The SAF Configuration Item for CCTT shall be inspected and tested to verify that the requirements as described in this specification paragraph 3.7.7 and Appendix F have been satisfied. The contractor shall supply all test equipment necessary to accomplish the inspections and tests specified herein. Requirements to be verified through demonstration shall utilize 30 randomly chosen collective tasks developed from the Government's prioritized List of Army Training Evaluation Program (ARTEP) Mission Training Plans (MTP).

4.8.15.1 Multiple Exercises.

The contractor shall demonstrate the capability of the SAF Configuration Item to control units in both single or multiple (2-5) exercise mode as specified in F.30.1.

4.8.15.1.1 SAF workstation.

The SAF workstation (F.30.1.1.1) shall be examined and tested to verify that the visual displays and user interfaces to control and monitor the performance of the SAF are provided. The furniture and chairs requirement of paragraph F.30.1.1.5 shall be verified by examination and demonstration. The capability to control up to a battalion task force of SAF platforms (ie. up to 120 SAF platforms) per SAF workstation shall be demonstrated.

4.8.15.1.1.1 Map display.

The contractor shall verify the workstation's map display requirements of F.30.1.1.1.1 by examination and demonstration.

4.8.15.1.1.2 Displays.

The SAF workstation's display requirements of F.30.1.1.1.2 shall be verified by demonstration.

4.8.15.1.1.3 Keyboard.

The SAF workstation shall be examined to verify that a keyboard and mouse (F.30.1.1.1.3) are provided.

4.8.15.1.2 Network interface.

The requirements of network interface of paragraph F.30.1.1.2 shall be verified by demonstration. This demonstration may be combined with the demonstrations of paragraph 4.8.12 of this specification.

4.8.15.1.3 Communications network.

The requirements of communications network of paragraph F.30.1.1.3 shall be verified by demonstration and test. The demonstration and test may be combined with the demonstrations and tests of paragraph 4.8.14.

4.8.15.1.4 Computer system.

The computer system requirements of F.30.1.1.4 shall be verified by examination and demonstration. The examination and demonstration may be combined with the examination and demonstration of paragraph 4.8.10.

The printer requirements of paragraph F.30.1.1.4.1 shall be verified by examination and demonstration. The database storage capacity and timing requirements of paragraph F.30.1.1.4.2 shall be verified by examination and demonstration.

4.8.15.1.5 SAF initialization mode.

The SAF initialization mode requirements of paragraph F.30.1.2.1 shall be verified by demonstrations. This demonstration may be combined with the demonstration of paragraph 4.8.10.

4.8.15.1.6 Commander mode.

The commander mode requirements of paragraph F.30.1.2.2 shall be verified by demonstration. This demonstration may be combined with the demonstration of paragraph 4.8.10.

4.8.15.1.6.1 Commander view submode.

The requirements of paragraph F.30.1.2.2.1 shall be verified by demonstration.

4.8.15.1.6.1.1 Battlefield view submode.

The requirements of paragraph F.30.1.2.2.1.1 shall be verified by demonstration.

4.8.15.1.6.2 Task organization capability.

The requirements of paragraph F.30.1.2.2.2 shall be verified by examinations and demonstrations. These demonstrations and examinations may be combined with the examinations and demonstrations of paragraph 4.8.1 through paragraph 4.8.10.

4.8.15.1.6.3 Overlay capability.

The Overlay capability of paragraph F.30.1.2.2.3 shall be verified by demonstration.

4.8.15.1.6.4 Combat Instruction Set (CIS).

The CIS requirements of paragraph F.30.1.2.2.4 shall be verified by analysis and demonstration.

4.8.15.1.6.5 SAF Simulation Software (SSS).

The SSS requirements of paragraph F.30.1.2.2.5 shall be verified by demonstration. The demonstration shall verify that the platforms simulate the specified vehicles, aircraft and weapon systems of paragraph F.30.1.2.2.5.

4.8.15.1.6.6 SAF Platforms.

The SAF platform requirements of paragraph F.30.1.2.2.6 shall be verified by analysis and demonstration.

4.8.15.1.6.7 SAF CIS and Parameter Custom Editor (s).

The SAF CIS and parameter custom editor requirements of paragraph F.30.1.2.2.7 shall be verified by demonstration.

4.8.15.1.6.8 SAF database tools.

The SAF database tool requirements of paragraph F.30.1.4 shall be verified by demonstration.

4.8.15.1.7 Not used.

4.8.16 Interoperability.

The CCTT and paragraph 3.2.1.2 shall be verified by demonstration and test.

4.8.17 M1A1 Module.

The M1A1 Module provided for the CCTT system shall be examined and demonstrated to verify that its design replicates the performance characteristics of the operational M1A1 tank, the common module design requirements of paragraphs 3.6 through 3.6.8, the system design requirements of paragraphs 3.2 through 3.2.3 of this specification, and associated systems as described in the following paragraphs.

4.8.17.1 Performance Characteristics.

The requirements of paragraph H.30.1.1 shall be considered verified by successful completion of the following:

4.8.17.1.1 Deleted.

4.8.17.1.2 Fire Control System.

The contractor shall demonstrate that the Fire Control System components, specified in paragraph H.30.1.1.2, of the M1A1 module replicate in design and performance the operational equipment. The Government will randomly examine and test Fire Control System components, and will conduct various training exercises where the capabilities of target sighting, aiming, and firing of the 120mm main gun, 0.50 caliber machine gun, M240 7.62 mm coaxial machine gun and M250 smoke grenade launcher can be accomplished. The selected exercises will include both stationary and moving targets that can be hit from stationary and on the move positions.

4.8.17.1.3 Weapons and Ammunition.

The contractor shall demonstrate that the M1A1 module meets the requirements for the weapons and ammunition specified in paragraph H.30.1.1.3. The Government will conduct various training exercises to verify the performance and modeling of the specified weapons and ammunition requirements.

4.8.17.1.4 Support Systems.

4.8.17.1.4.1 Electrical System.

The contractor shall demonstrate through actual exercise of the module that the electrical system operates in the different states as specified in paragraph H.30.1.1.4.1 and that the associated problems/capabilities are reflected in the M1A1 module.

4.8.17.1.4.2 Hydraulic System.

The contractor shall demonstrate through actual exercise of the module that the hydraulic system shall cover the use of both the main and auxiliary hydraulics pumps with the capabilities specified in paragraph H.30.1.1.4.2.

4.8.17.1.5 Depletable Resource Management.

The contractor shall demonstrate by actual exercise of the M1A1 module the capabilities of management, depletion, and resupply of both fuel and ammunition as specified in paragraph H.30.1.1.5. The contractor shall demonstrate that the crew has the capability to transfer fuel to the fuel tanks from a fuel carrier, and that resupply of fuel is coordinated through the ALOC. The contractor through exercise of the simulator shall demonstrate that the loader has the capability to identify, transfer, and resupply of main gun ammunition, and that the other crew members are capable of resupply and depletion of the machine gun ammunition. The contractor shall demonstrate that during use and resupply of fuel and ammunition, consideration has been given to the transfer times and depletion rates as defined in paragraph H.30.1.1.5.

4.8.17.1.6 Damage and Failure.

The contractor shall verify through demonstration and analysis that the specific list of components specified in paragraph H.30.1.1.6, are modeled for stochastic failures, deterministic failures and combat damage.

4.8.17.1.7 Sound Generation System.

The contractor shall verify through test that the sound generation system performs as specified in paragraphs H.30.1.1.7 through H.30.1.1.7.7.

4.8.17.1.8 Communication System.

The contractor shall verify by examination and demonstration that the M1A1 module provides the loader, gunner, tank commander, and driver stations with the radio and intercom capabilities specified in paragraph 3.7.6. The Government will verify performance and compliance with the requirements by conducting a training exercise that will allow for communication between crew members (via the use of the intercom select switches), OC and other desired modules in the simulation.

4.8.17.1.9 Visual Display System.

The contractor shall verify the visual display requirements of paragraph H.30.1.1.9 as specified in paragraph 4.8.13.6.12.1.

4.8.17.2 Physical Characteristics.

The M1A1 simulator module shall be examined to verify that it is provided with a driver and a turret compartment complying with the physical characteristics requirements specified in paragraph H.30.1.2. The Government will examine and test randomly selected equipment (controls, indicators, and other pieces of equipment) to verify that this equipment replicates the actual equipment found in the operational M1A1 tank.

4.8.17.2.1 Controls and Indicators.

The contractor shall demonstrate that design of controls and indicators for the M1A1 module is in accordance with the requirements of paragraphs H.30.1.2.1 through H.30.1.2.2.6. The Government will select a random number of controls and indicators of the individual crew stations as specified in paragraphs H.30.1.2.1 through H.30.1.2.2.6 to verify appropriate location, operability and realism.

4.8.17.2.2 External Interface Unit.

The contractor shall verify by examination and demonstration that the M1A1 module provides the external interface unit as specified in paragraph H.30.1.2.3.

4.8.18 M2A2/M3A2 Module.

The M2A2/M3A2 Module provided for the CCTT system shall be examined and demonstrated to verify that its design replicates the performance characteristics of the M2A2/M3A2 BFV, the common module design requirements of paragraphs 3.6 through 3.6.8, the system design requirements of paragraphs 3.2 through 3.2.3 of this specification, and associated systems as described in the following paragraphs.

4.8.18.1 Performance characteristics.

The requirements of paragraph I.30.1.1 shall be considered verified by successful completion of the following:

4.8.18.1.1 Deleted.

4.8.18.1.2 Fire Control System.

The contractor shall demonstrate that the Fire Control System components, specified in paragraph I.30.1.1.2, of the M2A2/M3A2 module replicate in design and performance the operational equipment. The Government will randomly examine and test the Fire Control System components, and will conduct various training exercises where the capabilities of target sighting, aiming, and firing of the M242 25-mm Automatic Gun , TOW Weapon System, M240C 7.62 mm Coaxial Machine Gun and M257 Smoke Grenade Launcher can be verified. The selected exercises will include both stationary and moving targets that can be hit from stationary and on the move positions.

4.8.18.1.3 Weapons and Ammunition.

The contractor shall demonstrate that the M2A2/M3A2 module meets the requirements for the weapons and ammunition specified in paragraph I.30.1.1.3. The Government will conduct various training exercises to verify the performance and modeling of the specified weapons and ammunition requirements.

4.8.18.1.4 Support Systems.

4.8.18.1.4.1 Electrical System.

The contractor shall demonstrate through actual exercise of the module that the electrical system operates in the different states as specified in paragraph I.30.1.1.4.1 and that the associated problems/capabilities are reflected in the M2A2/M3A2 module.

4.8.18.1.4.2 Hydraulic System.

The contractor shall demonstrate through actual exercise of the module that the hydraulic system operates in the different states as specified in paragraph I.30.1.1.4.2.

4.8.18.1.5 Depletable Resource Management.

The contractor shall demonstrate by actual exercise of the M2A2/M3A2 module the capabilities of management, depletion, and resupply of both fuel and ammunition as specified in paragraph I.30.1.1.5. The contractor shall demonstrate that the crew has the capability to transfer fuel to the fuel tanks from a fuel carrier, and that resupply of fuel is coordinated through the ALOC. The contractor through exercise of the simulator shall demonstrate that the commander has the capability to identify, transfer, and resupply of ammunition through the ALOC. The contractor shall demonstrate that during use and resupplying of fuel and ammunition, consideration has been given to the transfer times and depletion rates as defined in paragraph I.30.1.1.5.

4.8.18.1.6 Damage and Failure.

The contractor shall verify through test and analysis that the specific list of components specified in paragraph I.30.1.1.6, are modeled for stochastic failures, deterministic failures and combat damage.

4.8.18.1.7 Sound Generation System.

The contractor shall verify through demonstration that the sound generation system performs as specified in paragraphs I.30.1.1.7 through I.30.1.1.7.7.

4.8.18.1.8 Communication System.

The contractor shall verify by examination and demonstration that the M2A2/M3A2 module provides the vehicle commander, gunner, driver and three troop compartment crew stations with the radio and intercom capabilities specified in paragraph 3.7.6. The government will verify performance and compliance with the requirements by conducting a training exercise that will allow for communication between crew members (via the use of the intercom select switches), OC, and other desired modules in the simulation.

4.8.18.1.9 Visual display system.

The contractor shall verify the visual display system requirements of paragraph I.30.1.1.9 as specified in paragraph 4.8.13.6.12.2.

4.8.18.2 Physical characteristics.

The M2A2/M3A2 simulator module shall be examined to verify that it is provided with a driver, a turret compartment and troop compartment complying with the physical characteristics requirements as specified in paragraph I.30.1.2. The Government will examine and test randomly selected equipment (controls,indicators and other pieces of equipment) to verify that this equipment replicates the actual equipment found in the operational M2A2/M3A2 BFV.

4.8.18.2.1 Control and Indicators.

The contractor shall demonstrate that design of controls and indicators are in accordance with the requirements of paragraph I.30.1.2.1. The Government will select a random number of controls and indicators of the individual crew stations as specified in paragraphs I.30.1.2.1.1 through I.30.1.2.1.6 to verify appropriate location, operability, and realism.

4.8.18.2.2 External Interface Unit.

The contractor shall verify by examination and demonstration that the M2A2/M3A2 module provides the external interface unit as specified in paragraph I.30.1.2.2.

4.8.19 Dismounted infantry module.

The DI module shall be examined and demonstrated to verify that it operates in the CCTT environment and provides the infantry platoon leader, forward observer, and squad leaders with performance capabilities that replicates "real world" interactions as required by CCTT. The DI module shall also be examined and tested to verify the additional requirements as specified in 3.7.10, the common module design requirements of 3.6, the system design requirements of 3.2 through 3.2.3 of this specification, and associated systems as described in the following paragraphs.

4.8.19.1 Physical characteristics.

The DI module shall be examined and tested to verify that it is provided with one platoon leader, one forward observer position, and two squad leader positions that interact among themselves and with other system modules. The Government will examine and test randomly selected equipment (controls, indicators and other pieces of equipment) to verify that this equipment complies with the requirements of paragraphs 3.7.10.1 through 3.7.10.1.2.

4.8.19.2 Performance characteristics.

The requirements of paragraph 3.7.10.2 shall be considered verified by successful completion of the following:

a. The contractor shall demonstrate that the DI module design has the capability to simulate the weapons as specified in paragraph 3.7.10.2.1. The Government will conduct various training exercises to verify the performance and modeling of the specified weapons requirements.

b. The contractor shall verify by examination and demonstration that the DI module system has the capability to replicate real world activities of both the platoon and squad in the CCTT environment, and that the additional requirements of paragraph 3.7.10.2.2 have been met. The Government will conduct selected training collective tasks to verify that the requirements have been met.

c. The contractor shall demonstrate that the Fire Control System components (3.7.10.2.3) of the module replicate in design and performance the operational equipment. The Government will randomly examine and test Fire Control System components, and will conduct various exercises where the capabilities of target sighting, directing fire, and initiating artillery support can be verified. The selected exercises will include both stationary and moving targets that can be hit from stationary and on the move positions.

d. The contractor shall demonstrate by operation of the equipment, the capabilities of management, depletion, and resupply of both ammunition and personnel (3.7.10.2.4). The contractor shall demonstrate the capabilities of transport of the squad/platoon, M2A2/M3A2 BFV, and M113 APC for the weapons listed in paragraph 3.7.10.2.1, and that ammunition support as required by the FO is coordinated through the ALOC. The contractor shall also demonstrate that during monitoring of, use of, and resupplying of ammunition and personnel, consideration has been given to the transfer and depletion times as defined in paragraph 3.7.10.2.4.

4.8.19.3 Control and indicators.

The contractor shall demonstrate that the design of controls and indicators are in accordance with the requirements of paragraphs 3.7.10.3 through 3.7.10.3.2. The Government will select a random number of controls and indicators of the individual platoon leader position, forward observer position, and squad leader position as specified in paragraphs 3.7.10.3.1 and 3.7.10.3.2 to verify appropriate location, operability, and realism.

4.8.19.4 Visual display system.

The capabilities and characteristics of the visual system (3.7.10.4) shall be verified as specified in paragraph 4.8.13.6.12.7.

4.8.19.5 Communication System.

The contractor shall verify by examination and demonstration that the module provides normal communications between the platoon leader, squad leaders, M2A2/M3A2 BFV, and other modules as well as company headquarters and the Operations Center. The Government will verify performance and compliance with the requirements by conducting a training exercise that will allow for communication between the positions, CCTT system, OC, FO, and other desired modules in the simulation. The requirement of the radio capabilities (3.7.10.5.1) shall be verified by examination, and the performance shall be verify as in paragraph 4.8.19.5.

4.8.19.6 Sound generation system.

The contractor shall verify through demonstration and analysis that the sound generation system performs as specified in paragraphs 3.7.10.6 - 3.7.10.6.7.

4.8.20 FIST-V module.

The FIST-V Module provided for the CCTT system shall be examined and demonstrated to verify that its design replicates the performance characteristics of the M981 carrier, the common module design requirements of paragraphs 3.6 through 3.6.8, the system design requirements of paragraphs 3.2 through 3.2.3 of this specification, and associated systems as described in the following paragraphs. The contractor shall demonstrate that the FIST-V module has the capability to pinpoint targets for conventional artillery and to designate targets for laser-guided munitions and that the module has the capability to communicate with the fire support teams by means of the FED as defined in paragraph K.30.1.2.3.Verify by demonstration that the module provides the capability to locate, designate, and track targets using the devices as defined in paragraph K.30.1.2.2.

4.8.20.1 Performance characteristics.

The requirements of paragraph K.30.1.1 shall be considered verified by successful completion of the following:

4.8.20.1.1 Deleted.

4.8.20.1.2 Vehicle Weapon Systems.

The contractor shall demonstrate that the Vehicle Weapons System components of the FIST-V module, as specified in paragraph K.30.1.1.2, replicate in design and performance the operational equipment. The Government will randomly examine and test Vehicle Weapons components, and will conduct various training exercises where the capabilities of target sighting, aiming, and firing of the M60 Machine Gun and Smoke Grenades can be verified. The selected training exercises will include both stationary and moving targets that can be hit from stationary and on the move positions.

4.8.20.1.3 Weapons and Ammunition.

The contractor shall demonstrate that the FIST-V module design meets the requirements for the weapons and ammunition specified in paragraph K.30.1.1.3. The Government will conduct various training exercises to verify the performance and modeling of the specified weapons and ammunition requirements.

4.8.20.1.4 Support Systems.

4.8.20.1.4.1 Electrical System.

The contractor shall demonstrate through actual exercise of the module that the electrical system operates in the different states as specified in paragraph K.30.1.1.4.1, and that the associated problems/capabilities are reflected in the FIST-V module.

4.8.20.1.4.2 Hydraulic System.

The contractor shall demonstrate through actual exercise of the module that the hydraulic system operates in the different states as specified in paragraph K.30.1.1.4.2, and that the associated problems/capabilities are reflected in the FIST-V module.

4.8.20.1.5 Depletable Resource Management.

The contractor shall demonstrate by actual exercise of the module the capabilities of management, depletion, and resupply of both fuel and ammunition as specified in paragraph K.30.1.1.5. The contractor shall demonstrate that the crew has the capability to transfer fuel to the fuel tanks from a fuel carrier, and that resupply of fuel is coordinated through the ALOC. The contractor through exercise of the simulator shall demonstrate that the vehicle commander has the capability to identify, transfer, and resupply ammunition, and that resupply is coordinated through the ALOC. The contractor shall demonstrate that during use and resupply of fuel and ammunition, consideration has been given to the transfer times and depletion rates as defined in paragraph K.30.1.1.5.

4.8.20.1.6 Damage and Failure.

The contractor shall verify through test and analysis that the specific list of components specified in paragraph K.30.1.1.6, are modeled for stochastic failures, deterministic failures and combat damage.

4.8.20.1.7 Sound Generation System.

The contractor shall verify through demonstration that the sound generation system performs as specified in paragraphs K.30.1.1.7 through K.30.1.1.7.7.

4.8.20.1.8 Communication System.

The contractor shall verify by examination and demonstration that the FIST-V module provides the observer, targeting, communication, and driver stations with the radio and intercom capabilities of paragraph 3.7.6. The Government will verify performance and compliance with the requirements by conducting a training exercise that will allow for communication between crew members (via the use of the intercom select switches), OC, and other desired modules in the simulation.

4.8.20.1.9 Visual display system.

The contractor shall verify the visual display system requirements of paragraph K.30.1.1.9 as specified in paragraph 4.8.13.6.12.3.

4.8.20.2 Physical characteristics.

The FIST-V simulator module shall be examined to verify that it is provided with a consolidated enclosure consisting of a driver, targeting, observer and communication stations complying with the requirements paragraph K.30.1.2. The Government will examine and test randomly selected equipment to verify that this equipment replicates the actual equipment found in the operational FIST-V.

4.8.20.2.1 Control and indicators.

The contractor shall demonstrate that design of controls and indicators are in accordance with the requirements of paragraphs K.30.1.2.1 through K.30.1.2.6. The Government will select a random number of controls and indicators of the individual crew stations as specified in paragraphs K.30.1.2.1 through K.30.1.2.6 to verify appropriate location, operability, and realism.

4.8.20.2.2 External Interface Unit.

The contractor shall verify by examination and demonstration that the FIST-V module provides the external interface unit as specified in paragraph K.30.1.2.7.

4.8.21 M1A2 module.

The M1A2 Module provided for the CCTT system shall be examined and demonstrated to verify that its design replicates the performance characteristics of the operational M1A2 tank, the common module design requirements of paragraphs 3.6 through 3.6.8, the system design requirements of paragraphs 3.2 through 3.2.3 of this specification, and associated systems as described in the following paragraphs.

4.8.21.1 Performance characteristics.

The requirements of paragraph J.30.1.1 shall be considered verified by successful completion of the following:

4.8.21.1.1 Deleted.

4.8.21.1.2 Fire Control System.

The contractor shall demonstrate that the Fire Control System components of the M1A2 module, specified in paragraph J.30.1.1.2, replicate in design and performance the operational equipment. The Government will randomly examine and test Fire Control System components, and will conduct various training exercises where the capabilities of target sighting, aiming, and firing of the M256 120mm Main Gun, M240 7.62mm Coaxial Machine Gun, M2 0.50 caliber Machine Gun and M250 Smoke Grenade Launchers can be accomplished. The selected exercises will include both stationary and moving targets that can be hit from stationary and on the move positions.

4.8.21.1.3 Weapons and Ammunition.

The contractor shall demonstrate that the M1A2 module meets the requirements for the weapons and ammunition specified in paragraph J.30.1.1.3. The Government will conduct various training exercises to verify the performance and modeling of the specified weapons and ammunition requirements.

4.8.21.1.4 Support Systems.

4.8.21.1.4.1 Electrical System.

The contractor shall demonstrate through actual exercise of the module that the electrical system operates in the different states as specified in paragraph J.30.1.1.4.1 and that the associated problems/capabilities are reflected in the modules.

4.8.21.1.4.2 Hydraulic System.

The contractor shall demonstrate through actual exercise of the module that the hydraulic system shall cover the use of both the main and auxiliary hydraulics pumps with the capabilities specified in paragraph J.30.1.1.4.2.

4.8.21.1.5 Depletable Resource Management.

The contractor shall demonstrate by actual exercise of the M1A2 module the capabilities of management, depletion, and resupply of both fuel and ammunition as specified in paragraph J.30.1.1.5. The contractor shall demonstrate that the crew has the capability to transfer fuel to the fuel tanks from a fuel carrier, and that resupply of fuel is coordinated through the ALOC. The contractor through exercise of the simulator shall demonstrate that the loader has the capability to identify, transfer, and resupply main gun ammunition, and that the other crew members are capable of resupply and depletion of the machine gun ammunition. The contractor shall demonstrate that during use and resupply of fuel and ammunition, consideration has been given to the transfer times and depletion rates as defined in paragraph J.30.1.1.5.

4.8.21.1.6 Damage and Failure.

The contractor shall verify through test and analysis that the specific list of components as specified in paragraph J.30.1.1.6, are modeled for stochastic failures, deterministic failures and combat damage.

4.8.21.1.7 Sound Generation System.

The contractor shall verify through demonstration that the sound generation system performs as specified in paragraphs J.30.1.1.7 through J.30.1.1.7.7.

4.8.21.2 Communication system.

The contractor shall verify by examination and demonstration that the M1A2 module provide the loader, gunner, tank commander, and driver stations with the radio and intercom capabilities specified in paragraph 3.7.6. The Government will verify performance and compliance with the requirements by conducting a training exercise that will allow for communication between crew members (via the use of the intercom select switches), OC, and other desired modules in the simulation.

4.8.21.3 Visual Display System.

The contractor shall verify the visual display requirements of paragraph J.30.1.1.9 as specified in paragraph 4.8.13.6.12.1.

4.8.21.4 Physical Characteristics.

The M1A2 simulator module shall be examined to verify that it is provided with a driver and turret compartment complying with the physical characteristics requirements specified in paragraph J.30.1.2. The Government will examine and test randomly selected equipment (controls, indicators, and other pieces of equipment) to verify that this equipment replicates the actual equipment found in the operational M1A2 tank.

4.8.21.5 Controls and Indicators.

The contractor shall demonstrate that design of controls and indicators for the M1A2 module is in accordance with the requirements of paragraphs J.30.1.2.1 through J.30.1.2.2.6. The Government will select a random number of controls and indicators of the individual crew stations as specified in paragraphs J.30.1.2.1 through J.30.1.2.2.6 to verify appropriate location, operability, and realism.

4.8.21.6 External Interface Unit.

The contractor shall verify by examination and demonstration that the M1A2 module provides the external interface unit as specified in paragraph J.30.1.2.3.

4.8.22 M113A3 APC Module.

The M113A3 APC Module provided for the CCTT system shall be examined and demonstrated to verify that its design replicates the performance characteristics of the operational M113A3 APC, full tracked armored personnel carrier, the common module design requirements of paragraphs 3.6 through 3.6.8, the system design requirements of paragraphs 3.2 through 3.2.3 of this specification, and associated systems as described in the following paragraphs.

4.8.22.1 Performance characteristics.

The requirements of paragraph G.30.1.1 shall be considered verified by successful completion of the following:

4.8.22.1.1 Deleted.

4.8.22.1.2 Vehicle Weapon Systems.

The contractor shall demonstrate that the Vehicle Weapons System components of the M113A3 APC module, as specified in paragraph G.30.1.1.2, replicates in design and performance the operational equipment. The Government will randomly examine and test Vehicle Weapons components, and will conduct various training exercises where the capabilities of target sighting, aiming, and firing of the M2 0.50 Caliber Machine Gun and M257 Smoke Grenades Launcher can be verified. The selected training exercises will include both stationary and moving targets that can be hit from the stationary operating vehicle and on the move.

4.8.22.1.3 Weapons and Ammunition.

The contractor shall demonstrate that the M113A3 APC module meets the requirements for the weapons and ammunition specified in paragraph G.30.1.1.3. The Government will conduct various training exercises to verify the performance and modeling of the specified weapons and ammunition requirements.

4.8.22.1.4 Support Systems.

The contractor shall demonstrate through actual exercise of the module that the support systems operate in the different states as specified in paragraphs G.30.1.1.4 - G.30.1.1.4.2, and that the associated problems/capabilities are reflected in the M113A3 APC module.

4.8.22.1.5 Depletable Resource Management.

The contractor shall demonstrate by actual exercise of the M113A3 APC module the capabilities of management, depletion, and resupply of both fuel and ammunition specified in paragraph G.30.1.1.5. The contractor shall demonstrate that the crew has the capability to transfer fuel to the fuel tanks from a fuel carrier, and that resupply of fuel is coordinated through the ALOC. The contractor through exercise of the simulator shall demonstrate that the vehicle commander has the capability to identify, transfer, and resupply ammunition, and that resupply is coordinated through the ALOC. The contractor shall demonstrate that during use and resupply of fuel and ammunition, consideration has been given to the transfer times and depletion rates as defined in paragraph G.30.1.1.5.

4.8.22.1.6 Damage and Failure.

The contractor shall verify through test and analysis that the specific list of components as specified in paragraph G.30.1.1.6, are modeled for stochastic failures, deterministic failures and combat damage.

4.8.22.1.7 Sound Generation System.

The contractor shall verify through demonstration that the sound generation system performs as specified in paragraphs G.30.1.1.7 through G.30.1.1.7.7.

4.8.22.1.8 Communication System.

The contractor shall verify by examination and demonstration that the module provides the commander’s and driver stations with the radio and intercom capabilities of paragraph 3.7.6. The Government will verify performance and compliance with the requirements by conducting a training exercise that will allow for communication between crew members (via the use of the intercom select switches), OC, and other desired modules in the simulation.

4.8.22.1.9 Visual Display System.

The contractor shall verify the visual display system requirements of paragraph G.30.1.1.9 as specified in paragraph 4.8.13.6.12.5.

4.8.22.2 Physical Characteristics.

The M113A3 APC module shall be examined to verify that it is provided with a driver’s station and a commander’s station complying with the requirements of paragraph G.30.1.2. The Government will examine and test randomly selected equipment to verify that this equipment replicates the actual equipment found in the operational M113A3 APC.

4.8.22.2.1 Controls and Indicators.

The contractor shall demonstrate that design of controls and indicators are in accordance with the requirements of paragraphs G.30.1.2.1 through G.30.1.2.2. The Government will select a random number of controls and indicators of the individual crew stations as specified in paragraphs G.30.1.2.1 and G.30.1.2.2 to verify appropriate location, operability, and realism.

4.8.22.2.2 External Interface Unit.

The contractor shall verify by examination and demonstration that the M113A3 APC module provides the external interface unit as specified in paragraph G.30.1.2.3.

4.8.23 HMMWV module.

The HMMWV Module provided for the CCTT system shall be examined and demonstrated to verify that its design replicates the performance characteristics of the operational HMMWV, the common module design requirements of paragraphs 3.6 through 3.6.8, the system design requirements of paragraphs 3.2 through 3.2.3 of this specification, and associated systems as described in the following paragraphs.

4.8.23.1 Performance characteristics.

The requirements of paragraph L.30.1.1 shall be considered verified by successful completion of the following:

4.8.23.1.1 Deleted.

4.8.23.1.2 Vehicle Weapon Systems.

The contractor shall demonstrate that the Vehicle Weapons System components of the HMMWV module, specified in paragraph L.30.1.1.2, replicate in design and performance the operational equipment. The Government will randomly examine and test Vehicle Weapons components, and will conduct various training exercises where the capabilities of target sighting, aiming, and firing of the MK-19 40 mm automatic gun, M249 SAW, M60 Machine Gun, and .50 Cal.

Machine Gun can be verified. The selected training exercises will include both stationary and moving targets that can be hit from a vehicle stationary position and in the dismounted mode.

4.8.23.1.3 Weapons and Ammunition.

The contractor shall demonstrate that the HMMWV module meets the requirements for the weapons and ammunition specified in paragraph L.30.1.1.3. The Government will conduct various training exercises to verify the performance and modeling of the specified weapons and ammunition requirements.

4.8.23.1.4 Electrical System.

The contractor shall demonstrate through actual exercise of the module that the electrical system operates in the different states as specified in paragraph L.30.1.1.4.1, and that the associated problems/capabilities are reflected in the HMMWV module.

4.8.23.1.5 Depletable Resource Management.

The contractor shall demonstrate by actual exercise of the HMMWV module the capabilities of management, depletion, and resupply of both fuel and ammunition as specified in paragraph L.30.1.1.5. The contractor shall demonstrate that the crew has the capability to transfer fuel to the fuel tanks from a fuel carrier, and that resupply of fuel is coordinated through the ALOC. The contractor through exercise of the simulator shall demonstrate that the vehicle commander has the capability to identify, transfer, and resupply ammunition, and that resupply is coordinated through the ALOC. The contractor shall demonstrate that during use and resupply of fuel and ammunition, consideration has been given to the transfer times and depletion rates as defined in paragraph L.30.1.1.5.

4.8.23.1.6 Damage and Failure.

The contractor shall verify through test and analysis that the specific list of components specified in paragraph L.30.1.1.6, are modeled for stochastic failures, deterministic failures and combat damage.

4.8.23.1.7 Sound Generation System.

The contractor shall verify through demonstration that the sound generation system performs as specified in paragraphs L.30.1.1.7 through L.30.1.1.7.7.

4.8.23.1.8 Communication System.

The contractor shall verify by examination and demonstration that the HMMWV module provides the driver and forward observer stations with the radio capabilities of paragraph 3.7.6. The Government will verify performance and compliance with the requirements by conducting a training exercise that will allow for communication between crew members, OC, and other desired modules in the simulation.

4.8.23.1.9 Visual display system.

The contractor shall verify the visual display system requirements of paragraph L.30.1.1.9 as specified in 4.8.13.6.12.6.

4.8.23.2 Physical characteristics.

The HMMWV module shall be examined to verify that it is provided with a consolidated enclosure for the driver and observer positions complying with the requirements of paragraph L.30.1.2. The Government will examine and test randomly selected equipment to verify that this equipment replicates the actual equipment found in the operational HMMWV.

4.8.23.2.1 Control and indicators.

The contractor shall demonstrate that design of controls and indicators are in accordance with the requirements of paragraph L.30.1.2.1. The Government will select a random number of controls and indicators of the individual crew stations as specified in paragraphs L.30.1.2.1.1 and L.30.1.2.1.3 to verify appropriate location, operability, and realism.

4.8.23.2.2 External Interface Unit.

The contractor shall verify by examination and demonstration that the HMMWV module provides the external interface unit as specified in paragraph L.30.1.2.2.

4.8.24 System design

The contractor shall verify by examination and test that the CCTT system architecture meets the requirements as specified in paragraph 3.2

4.8.25 CCTT system performance

The contractor shall verify by examination and demonstration that the CCTT system implements the system performance techniques and design requirements as specified in paragraph 3.2.1.

4.8.26 CCTT system standards

The contractor shall verify by examination and test that the CCTT system design is based on the requirements specified in paragraph 3.2.1.3.

4.8.27 System latency

The contractor shall verify by analysis and demonstration that the CCTT system response latency meets the requirements as specified in paragraphs 3.2.2.1 - 3.2.2.2.

4.8.28 Dead reckoning algorithms (DRAs)

The contractor shall verify by analysis that DRA methodology requirements specified in paragraph 3.2.3 are met.

4.8.29 Design modularity

The contractor shall verify by examination and test that the modular design requirements specified in paragraph 3.2.5 are implemented.

4.8.29.1 Model designs

The contractor shall verify by analysis and test that all mathematical model requirements specified in paragraph 3.2.5.1 are met.

4.8.30 Personnel

The contractor shall verify by examination that personnel are able to train within the requirements specified in paragraphs 3.5 - 3.5.2.

4.8.31 Training system definition

The contractor shall verify by examination that the training system configuration requirements specified in paragraph 3.1 are met.

4.8.32 Not Used

4.8.33 Interface definitions

4.8.33.2 Terrain Database interface

The contractor shall verify by examination that the requirements specified in paragraph 3.1.3.1.5 to provide an external interface with TSSE are met.

4.8.33.3 TSSE to MC (MCC)

The contractor shall verify by examination and demonstration that the requirements specified in paragraph 3.1.3.2.1.1 to provide an interface between the TSSE and both the MC and MCC are met.

4.9 Environmental tests.

The contractor shall verify the requirements of (3.2.10 - 3.2.10.5) and 3.8.2 as follows:

a. The contractor shall provide an analysis and certification, acceptable to the Government, to verify that the CCTT hardware design will meet the environmental conditions of (3.2.10-3.2.10.5) and 3.8.2. The analysis and certification shall verify that all parts are mounted adequately to prevent loosening, damaging, and disturbing settings and adjustments encountered during handling, transportation, and service environments. The requirements of temperature and relative humidity shall also be verified by the successful completion of the analysis and demonstration of 4.24 of this specification.

b. For Mobile CCTT equipment.

(1) Mobile CCTT equipment shall be tested in accordance with MIL-STD-810, method 514.4, Procedures I and II. For basic transportation; test levels and conditions shall be as specified in I-3.3.1.2 of method 514.4. The test duration shall be based on 2000 miles of expected transportation. The tests shall be conducted nonoperational and at ambient temperatures. For the large assembly transport, test levels, conditions, and duration shall be as specified in I-3.3.2.2 and I-3.3.2.3 of method 514.4. At the conclusion of the test, the equipment shall not suffer from any degradation in performance.

(2) Mobile CCTT equipment shall be tested in accordance with MIL-STD-810, Method 507.3, Procedure II for a minimum of seven 24-hr cycles. At the conclusion of the test, the equipment shall not show any damage nor any degradation of performance.

(3) The test shall be conducted nonoperational and at ambient temperatures. At the conclusion of the test, the equipment shall not suffer from any damage or degradation of performance.

(4) Mobile CCTT equipment shall be tested in accordance with MIL-STD-810, Method 502.3, Procedures I and II. The internal chamber temperature shall be stabilized following the guidance of MIL-STD-810, paragraphs 5.1.3.1 and 5.1.3.2 and maintained at the stabilized temperature for a minimum of 4 hours. At the conclusion of the test, the equipment shall not suffer from any damage or degradation of performance.

(5) Mobile CCTT equipment shall be tested in accordance with MIL-STD-810, Method 505.3, Procedure I. The internal chamber temperature shall be stabilized following the guidance of MIL-STD-810, paragraphs 5.1.3.1 and 5.1.3.2. A minimum of 3 cycles (24 hour period per cycle) shall be conducted for Procedure I. At the conclusion of the test, the equipment shall not suffer from any damage or any degradation of performance.

(6) After exposure to each environment specified [4.9 (1, 2, 3, 4, 5)], the equipment shall be operated to verify compliance with Tables VII, VIII, and IX of this specification.

4.10 Electromagnetic interference.

Deleted.

4.10.1 EMC electrical grounding.

Deleted.

4.10.2 Trainer system ESD tests.

Deleted.

4.10.3 Trainer system EMC tests.

Deleted.

4.10.4 Conducted emissions, conducted susceptibility and radiated susceptibility.

Radiated emission testing shall take place with a worst case exercise being executed on the module under test and the Daily Readiness Check being executed on all other modules and workstations. Radiated susceptibility, conducted emission, and conducted susceptibility testing shall take place with each CCTT module and workstation executing the Daily Readiness Check.

4.11 Built-in-test.

The trainer system shall be tested to verify the requirements of paragraph 3.2.9.2.1 of this specification.

4.12 Safety test.

A Certified Health Physicist (American Board of Health Physics) shall perform radiation rate exposure surveys using a NIST traceable survey meter. The CCTT shall be examined in conjunction with the CCTT Safety Assessment Report to verify compliance with the requirements of paragraphs 3.3.3 through 3.3.3.4 of this specification.

4.13 Reliability demonstrations.

The contractor shall conduct a reliability assessment for the CCTT system to include manned modules, consoles, workstations, and network equipment designated in paragraph 3.2.8.1 of this specification. Failures shall be scored by the failure review board (FRB) IAW the CCTT Failure Definition and Scoring Criteria (FDSC). Only FDSC failures attributed to hardware causes will be used to estimate MTBF’s. Data for the reliability assessment shall be collected during power-on time accumulated throughout integration and formal testing. Mission scenario failures attributable to hardware, software, BITE, and technical documentation occurring during formal testing will be tracked and reported VIA the FRB. A thermal survey shall be performed during the reliability assessment period. Emerging results from the thermal survey and analysis of failed items will be reported to the FRB and as part of the quarterly reliability status report.

4.13.1 Not Used.

4.13.2 FSD/Production reliability.

At the end of FSD, the contractor shall conduct reliability assessment for fixed site and mobile configurations to demonstrate achievement of the MTBF quantitative values listed in paragraph 3.2.8.1 of this specification.

4.14 Maintainability.

The CCTT shall be examined and verified through analysis compliance with the qualitative requirements of paragraphs 3.2.9. through 3.2.9.3 of this specification.

4.14.1 Maintainability demonstration.

A maintainability demonstration shall be conducted in accordance with a modified MIL-STD-471 stratification approach to verify the requirements of paragraph 3.2.9.1 of this specification. The tasks to be demonstrated shall be selected from the approved list of maintainability demonstration candidate tasks.

4.15 Human factors engineering.

The CCTT shall be examined to verify compliance with the requirements of paragraph 3.3.4 of this specification.

4.16 Not Used.

4.17 Material and processes.

The contractor shall provide a certificate of compliance that verifies that the materials and processes used in CCTT components comply with the requirements of paragraph 3.3.1. Random samples of each component shall be examined to validate the certificate of compliance.

4.17.1 Color.

The contractor shall provide a certificate of compliance that verifies that the requirements of paragraph 3.2.7.9 have been complied with. Random samples of CCTT components shall be examined to validate the certificate of compliance.

4.17.2 Derating criteria.

The contractor shall verify by analysis and test that the equipment items which are not commercially available or are not GFE meet the requirement of paragraph 3.2.8.2. The thermal survey to be conducted prior to the reliability qualification test of paragraph 4.13 shall verify this requirement.

4.18 Mobile configuration.

The Mobile CCTT shall be examined and tested to verify that its design provides the required collocated work stations of paragraph 3.8.1 and with the capabilities as specified in paragraphs 3.8 through 3.8.5.3. Noncompliance with any specified examination or test or presence of one or more defects shall constitute cause for rejection.

4.18.1 Environmental conditions.

The Mobile CCTT environmental conditions of paragraphs 3.8.2 through 3.8.2.2 and 3.8.3 shall be verified as specified in paragraph 4.9 of this specification.

4.18.1.1 Lightning protection.

The Mobile CCTT configuration shall be examined and tested to verify the lightning requirements of paragraph 3.8.2.3.

4.18.2 Semitrailers.

Each semitrailer shall be examined and tested for compliance with the general requirements as specified in paragraph 3.8.4. This element of inspection shall encompass all visual examinations, dimensional measurements, and tests as specified herein.

4.18.2.1 Treatment, painting, identification marking, and data plates.

A certification regarding the body cleaning, treatment, prime painting, identification marking, data plates and registration numbers requirements of paragraph 3.8.4.1 and as required by MIL-STD-1223 and FED-STD-595 shall be presented to Government representatives for examination and approval.

4.18.2.2 Color.

A certification regarding the color requirements of paragraph 3.8.4.2 shall be presented to Government representatives for examination and approval.

4.18.2.3 Rustproofing.

A certification regarding the rustproofing requirements of paragraph 3.8.4.3 shall be presented to Government representatives for examination and approval.

4.18.2.4 Hardwood.

A certification regarding the hardwood requirements of paragraph 3.8.4.4 shall be presented to Government representatives for examination and approval.

4.18.2.5 Wood treatment.

A certification regarding the wood treatment requirements of paragraph 3.8.4.5 shall be presented to Government representatives for examination and approval.

4.18.2.6 Weights, loads, dimensions.

4.18.2.6.1 Net weight.

The semitrailer shall be weighed to verify compliance with the net weight requirements of paragraph 3.8.4.6.1.

4.18.2.6.2 Rated payload capacity.

The semitrailer shall be weighed to verify compliance with the rated payload capacity requirements of paragraph 3.8.4.6.2.

4.18.2.6.3 Gross weight.

The semitrailer shall be weighed to verify the gross weight requirements of paragraph 3.8.4.6.3.

4.18.2.6.4 Dimensions.

The semitrailer shall be measured to verify compliance with the external dimensions of paragraph 3.8.4.6.4.1 and the interior dimensions of paragraph 3.8.4.6.4.2.

4.18.2.6.5 Wheel loading.

The semitrailer shall be weighed to verify the wheel loading requirements of paragraph 3.8.4.6.5.

4.18.2.7 Performance.

The semitrailer shall be tested to verify compliance with the performance requirements of paragraphs 3.8.4.7 through 3.8.4.7.4. This test may be combined with the road test requirement of paragraph 4.18.4.

4.18.2.7.1 Brakes performance.

The semitrailer service brakes shall be tested to comply with the brake performance requirements of paragraph 3.8.4.7.3 and 3.8.4.12. This test may be combined with the road test requirement of 4.18.4.

4.18.2.7.2 Slope and grade.

The semitrailer shall be tested to verify compliance with the slope and grade requirements of paragraph 3.8.4.7.4. This test may be combined with the road test requirement of paragraph 4.18.4.

4.18.2.8 Suspension system.

Each semitrailer shall be examined to verify conformance with the suspension system requirements of paragraph 3.8.4.8. The capabilities of the suspension system shall be demonstrated by means of the semitrailer weight test of paragraph 4.18.2.6, performance test of paragraph 4.18.2.7, and the road test of paragraph 4.18.4.

4.18.2.9 Axles.

Each semitrailer shall be examined and tested to verify conformance with the axles requirements of paragraph 3.8.4.9. The weight test of paragraph 4.18.2.6, performance test of paragraph 4.18.2.7, and road test of 4.18.4 shall be used to verify the axles requirements. Upon completion of these tests the equipment shall show no evidence of damage, misalignment, binding, leaking, or other malfunction.

4.18.2.10 Inner tubes, wheel, and tire balancing.

The semitrailer shall be examined, certified, and tested to verify compliance with the requirements of paragraphs 3.8.4.10 through 3.8.4.10.3. This test may be combined with the test of paragraph 4.18.2.8 above.

4.18.2.11 Rear wheel splash and stone throw protection.

The semitrailer shall be examined and certified to comply with mud flaps and splash and stone throw protection requirements of paragraph 3.8.4.11.

4.18.2.12 Brakes.

The brakes requirements of paragraph 3.8.4.12 shall be verify as specified in paragraph 4.18.2.7.1 above.

4.18.2.13 Upper fifth wheel plate.

The semitrailer shall be examined, certified, and tested to verify compliance with the upper fifth wheel requirements of paragraph 3.8.4.13.

4.18.2.14 Landing gear and leveling jacks.

The semitrailer shall be examined to verify conformance with the landing gear and leveling jacks requirements of paragraph 3.8.4.14 and as required by MIL-S-45344. The contractor shall demonstrate the requirements by means of the road test of 4.18.4 and weight test of paragraph 4.18.2.6. In addition, the leveling requirement on any slope of up to 5 degrees (over short dimension of the semitrailer) and 1 degree (over the long dimension of the semitrailer) shall be demonstrated during uncoupling operations. Upon completion of the road test, the semitrailer shall be examined to verify that no foreign matter has entered the mechanism of the landing gear. The semitrailer shall be uncoupled to verify the operation of the landing gear and leveling jack mechanisms.

4.18.2.15 Level indicators.

The semitrailer shall be examined and tested to verify conformance with the level indicators requirements of paragraph 3.8.4.15. The operation of the bubble level indicators shall be demonstrated by the test of paragraph 4.18.2.14 above. The readout tilts shall be demonstrated to be within the specified tolerances.

4.18.2.16 Lifting and tiedown attachments.

The semitrailer shall be examined, certified, and tested to verify conformance with the lifting fittings and tiedown attachments requirements of paragraph 3.8.4.16. A wind resistance analysis shall be performed to verify compliance with the tiedown attachments requirements of paragraph 3.8.4.16.

4.18.2.17 Rear end protection.

The semitrailer shall be examined and certified to verify compliance with the bumper requirements of paragraph 3.8.4.17.

4.18.2.18 Lubrication.

The semitrailer shall be examined and certified to verify compliance with the lubrication requirements of paragraph 3.8.4.18.

4.18.2.19 Body construction.

The semitrailer body shall be examined and tested to verify compliance with the body construction requirements of paragraphs 3.8.4.19 through 3.8.4.19.6. An analysis shall be provided to verify that the platform (3.8.14.19.1), roof (3.8.4.19.3), and floors (3.8.4.20.3) can withstand the rated payload and loads as specified.

4.18.2.19.1 Side wall and roof framing.

The side wall and roof framing of the semitrailer shall be examined and measured to verify compliance with the requirements of paragraph 3.8.4.19.2.

4.18.2.19.2 Front end.

The front end of the semitrailer shall be examined and measured to verify compliance with the requirements of paragraph 3.8.4.19.4.

4.18.2.19.3 External doors/rear doors.

The semitrailer shall be examined and tested to verify conformance with the external doors of paragraph 3.8.4.19.5 and the rear doors requirements of paragraph 3.8.4.19.5.1. The adequacy of the door's insulation and gaskets shall be verified by means of the environmental tests of paragraph 4.9 and rain test of paragraph 4.18.

4.18.2.19.4 Other external doors.

The other external doors of the semitrailer shall be examined, certified, and tested to verify the requirements of paragraph 3.8.4.19.5.2. The adequacy of the thermal protection requirements of paragraph 3.8.4.19.6 shall be verified by means of the environmental tests of paragraph 4.9.

4.18.2.20 Interior construction.

The semitrailer shall be examined to verify compliance with the interior construction requirements of paragraphs 3.8.4.20 through 3.8.4.20.4.

4.18.2.21 Semitrailer lighting.

The semitrailer shall be examined, tested, and certified to verify conformance with the lighting requirements of paragraphs 3.8.4.21 through 3.8.4.21.3.

4.18.2.21.1 Twelve Volt Direct Current (VDC) system.

The semitrailer shall be examined and certified to verify compliance with the 12 VDC system requirements of paragraph 3.8.4.21.1.1.

4.18.2.21.2 Receptacle 12 VDC.

The semitrailer shall be examined and certified to verify compliance with the requirements of paragraph 3.8.4.21.1.2.

4.18.2.21.3 Interconnected 24VDC system.

The semitrailer shall be examined and tested to verify compliance with the requirements of paragraph 3.8.4.4.21.1.3.

4.18.2.21.4 Receptacle, 24 VDC.

The semitrailer shall be examined and certified to verify that it is provided with a 24 VDC Receptacle system conforming with the requirements of paragraph 3.8.4.21.1.4 and as required by MIL-S-45344. The electrical test of paragraph 4.4.9 of MIL-S-45344 shall be conducted to verify conformance with the requirements.

4.18.2.22 External platforms, railings, and stairways.

The semitrailer shall be examined to verify conformance with the external platforms, railings, and stairways requirements of paragraph 3.8.4.22. The contractor shall demonstrate that the platforms, railings, and stairways are easy to set-up, adjust, dismantle, store, and transport. This shall be accomplished by conducting a set-up and tear down demonstration of the vehicle before and after transportation.

4.18.2.23 Environmental Control System (ECS).

The semitrailer shall be examined and tested to verify conformance with the environmental control system (ECS) requirements of paragraph 3.8.4.23. The capabilities of the ECS shall be verified by means of the environmental tests of paragraph 4.9.

4.18.2.23.1 Cooling units.

The semitrailer shall be examined and tested to verify conformance with the cooling units requirements of paragraph 3.8.4.23.1. The capabilities of the cooling units shall be verified by means of the environmental tests of paragraph 4.9.

4.18.2.23.2 Heating.

The semitrailer shall be examined and tested to verify conformance with the heating requirements of paragraph 3.8.4.23.2 The capabilities of the heating system shall be verified by means of the environmental tests of paragraph 4.9.

4.18.2.23.3 Control Circuits.

The semitrailer shall be examined to verify conformance with the controls circuits requirements of paragraph 3.8.4.23.3.

4.18.2.23.4 Air Filters.

The semitrailer shall be examined and certified to verify conformance with the air filters requirements of paragraph 3.8.4.23.4.

4.18.2.23.5 Maintainability.

A maintenance demonstration shall be conducted to verify that the ECS equipment is maintainable (3.8.4.23.5) without removing it from the semitrailer.

4.18.2.24 Humidity control.

The semitrailer shall be examined and tested to verify the humidity control requirements of paragraph 3.8.4.24. The performance of the humidity control device shall be verified by means of the environmental tests of paragraph 4.9.

4.18.2.25 Fire extinguishers.

The semitrailer shall be examined to verify that it is furnished with fire extinguishers located as specified in paragraph 3.8.4.25.

Performance of shall be verified by means of the safety tests to be conducted by the contractor.

4.18.2.26 Alarm system.

The semitrailer shall be examined and tested to verify the alarm system requirements of paragraph 3.8.4.26. Performance of the alarm system shall be verified by means of the safety tests to be conducted by the contractor.

4.18.2.27 Telephone system.

The semitrailer shall be examined and tested to verify that the telephone system requirements of paragraph 3.8.4.27 have been met.

4.18.2.28 Furniture and chairs.

The semitrailer shall be examined, certified, and tested to verify the requirements of paragraph 3.8.4.28.

4.18.2.29 Provisions for maintenance work space.

The semitrailer shall be examined and measures taken to verify the provisions for maintenance work space as required by paragraph 3.8.4.29.

4.18.2.30 Provisions for storage of support equipment and materials.

The semitrailer shall be examined and tested to verify that the provisions for storage of support equipment and materials of paragraph 3.8.4.30 have been met. The road test of paragraph 4.18.4 shall be used to verify the adequacy of the means provided to secure items during transport; i.e., furniture, chairs, cables, and other non-mounted trainer equipment.

4.18.2.31 Electrical system.

The semitrailer shall be examined, certified, and tested to verify requirements of paragraphs 3.8.4.31 through 3.8.4.32. The external utility assemblies of 3.8.4.31.2 shall be examined after conclusion of the environmental tests of paragraph 4.9 and the rain test of paragraph 4.18.5. Any evidence of water penetration into these assemblies shall constitute failure of the electrical system.

4.18.2.32 External panels and cables.

The semitrailer shall be examined, tested, and certified to verify compliance with the requirements of paragraph 3.8.4.32. The cables, panels, cable and panel connectors, cable jackets and connector connections shall be examined after conclusion of the environmental tests of paragraph 4.9 and the rain test of paragraph 4.18.5. Any evidence of cracking, deterioration or water penetration shall constitute failure of the external panels and cables.

4.18.2.33 External operations center provisions.

The semitrailer shall be examined and tested to verify compliance with the requirements of paragraph 3.8.4.34.

4.18.3 Portable Power System (PPS).

The PPS shall be examined, certified, and tested to verify compliance with the requirements of paragraphs 3.8.5 through 3.8.5.3.

4.18.4 Road test.

The road test shall consist of coupling the semitrailer loaded with rated payload to a truck-tractor. The tractor combination shall be driven a distance of not less than 50 miles and shall include turns up to 90 degrees right and left. At least 20 percent of the distance shall be over hard uneven terrain. At least five sudden stops shall be made from a speed of not less than 20 mph. Tracking and turning ability shall be observed to verify conformance with paragraph 3.8.4.7.1 and 3.8.4.7.2. Any evidence of misalignment, binding, leaking, or other malfunction shall constitute failure of the semitrailer.

4.18.5 Rain test.

The mobile CCTT shall be tested IAW the rain test of MIL-STD-810, Method 506.2, Procedure I, or Procedure III if a blowing-rain facility is not available or practical. The test item shall be operated at the end of the rain IAW the test plan. Any evidence of water penetration into the test item enclosure following the rain test shall be considered a failure.

4.19 Weight.

The contractor shall provide an analysis to verify the weight requirements of paragraph 3.2.7.1.

4.20 Ceiling height.

The contractor shall verify the ceiling height requirements of paragraph 3.2.7.2 by measurement.

4.21 Equipment access.

The contractor shall verify the equipment access requirements of paragraph 3.2.7.3 by measurement.

4.22 Trainer maintenance access.

The contractor shall verify the trainer maintenance access requirements of paragraph 3.2.7.4 by measurement.

4.23 Power requirements.

The contractor shall provide an analysis and test to document that the CCTT (fixed and mobile) can operate without degradation on the power requirements of paragraphs 3.2.7.5 through 3.2.7.5.5 and 3.8.5 through 3.8.5.3 of this specification. The analysis shall show that major CCTT electrical components can operate without degradation over the required voltage and frequency variation. The test shall consist of input power and voltage and frequency variation.

4.24 Equipment cooling.

The contractor shall provide an analysis (air-conditioning cooling load) and demonstration to verify that the requirements of paragraph 3.2.7.6 have been met. The demonstration shall consist of actual operation of the CCTT modules at full capacity with full personnel loading and verifying that the conditions inside the modules do not exceed 80 degrees Fahrenheit.

4.25 Lighting.

The contractor shall verify by examination and test the lighting requirements of paragraph 3.2.7.7.

4.26 Grounding.

The contractor shall verify by examination and test the grounding requirements of paragraphs 3.2.7.8 through 3.2.7.8.1.

4.27 Cabling.

The contractor shall verify by examination the cable installation requirements specified in paragraph 3.2.7.10.

4.28 Transportability

The CCTT equipment shall be visually examined to verify conformance with the transportability requirements of paragraph 3.2.11. This requirement shall also be verified by means of the analysis and test of paragraph 4.9.

5.0 PREPARATION FOR DELIVERY.

5.1 Preservation, packaging, and packing.

Preservation, packaging and packing for CCTT components shall be in accordance with MIL-A-83995, level of protection ”A” to ensure against deterioration and damage during handling, transit, and storage.

5.2 Marking.

Interior packages and exterior shipping containers shall be marked in accordance with MIL-STD-129.

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6. NOTES.

6.1 Notes applicability.

The definitions of MIL-STD-454 are applicable.

6.2 Revision Annotation.

Symbols are not used in this revision to identify changes with respect to the previous issue, by direction of the government.

6.3 Definitions.

Definitions shall be in accordance with the following:

6.3.1 Interface equipment definition.

Interface equipment is that equipment which controls, transmits, encodes, decodes, converts, receives, or buffers analog, digital, or discrete information passing between the trainer computers and the trainee stations, supervisor stations, and any other simulation hardware. The interface equipment includes digital-to-discrete, discrete-to-digital, selection switching, and logic signal level converters.

6.3.2 Scheduled maintenance.

Scheduled maintenance is defined as those tasks performed at predetermined time intervals in accordance with approved maintenance documentation prepared by the contractor to ensure continuing satisfactory operation of equipment; also ”planned maintenance”.

6.3.3 Operational Mode Summary/Mission Profile (OMS/MP) and Failure Definition and Scoring Criteria (FD/SC).

See Appendix C

6.3.4 Acronyms.

AAR	After Action Review
AAWS-M	Anti-Armor Weapon System - Medium
AC	Active Component
ACE	Armored Combat Earthmover
ACGIH	American Conf. of Governmental Hygienists
ACK	Acknowledge
ACMT	Automated Configuration Management Tool
ADATS	Air Defense Anti-Tank System
ADCATT	Air Defense Combined Arms Tactical Trainer
ADL	Ada Design Language
AFAS	Advanced Field Artillery System
AFATDS	Adv. Field Artillery Tactical Data System
AFOV	Apparent field of view
AI	Artificial Intelligence
ALOC	Administrative Logistics Center
ANCOC	Advanced Non-Commissioned Officer Course
ANSI	American National Standards Institute
AOAC	Armor Officer Advanced Course
AOBC	Armor Officer Basic Course

APC	Armor Personnel Carrier
APDS	Armor-Piercing Discarding SABOT
APDS-T	Armor-Piercing Discarding Sabot w/ Tracer
APFSDS	Armor-Piercing Fin-Stabilized Disc. SABOT
APICM	Anti-Personnel Imprvd. Cnvntnl. Munitions
APU	Auxiliary Processing Units
ARTEP	Army Training Evaluation Program
ASM	Armor Systems Modernization
ASTM	American Society for Testing and Materials
ATACMS	Advanced Tactical Missile System
ATCCS	Army Tactical Command and Control System
AVLB	Armored Vehicle Launched Bridge
BBN	Bolt, Berenek, and Newman
BCC	Bradley Commander Course
BFV	Bradley Fighting Vehicle
BIT	Built-In-Test
BITE	Built-In-Test Equipment
BLUFOR	U.S. friendly, and/or supporting forces
BNCOC	Basic Non-Commissioned Officer Course
BTU	British Thermal Unit
Cal	Caliber
CAS	Close Air Support
CBT	Computer Based Training
CCA	Circuit Card Assembly
CCHA	Commander’s Control Handle Assembly
CCP	Computer Control Panel
CCTT	Close Combat Tactical Trainer
CES	Combat Engineering Support
CEU	Computer Electronics Unit
CEV	Combat Engineer Vehicle
CFE	Contractor-Furnished Equipment
CFR	Code of Federal Regulation
CFS	Command from a Simulator
CFX	Command Field Exercise
CHP	Commander’s Popped Hatch
CIG	Computer Image Generation
CIS	Combat Instruction Set
CITV	Commander’s Independent Thermal Viewer
CLAMS	Cleared Lane Marking System
CLS	Contractor Logistic Support
cm	Centimeter
COMSEC	Communications Security
CONUS	Continental United States

COTS	Commercial Off-The-Shelf
CPH	Commander Popped Hatch
CPI	Characters Per Inch
CRT	Cathode Ray Tube
CSCI	Computer Software Configuration Item
CSS	Combat Service Support
CTCP	Combat Trains Command Post
CVC	Combat Vehicle Crewman's Helmet
DAG	Division Artillery Group
db	Decibels
DESIG	Target Designate
DFAD	Digital Feature Analysis Data
DI	Dismounted Infantry
DIS	Distributed Interactive Simulation
DMA	Defense Mapping Agency
DMD	Digital Message Device
DOD	Department of Defense
DOT	Department of Transportation
DPICM	Dual-Purpose Imprvd. Cnvntnl. Munitions
DRA	Dead Reckoning Algorithms
DTD	Digital Terrain Data
DTED	Digital Terrain Elevation Data
DTV	Direct Thermal Viewer
ECAC	Electromagnetic Compatibility Analysis Center
ECCM	Electronic Counter-Countermeasures
ECM	Electronic Countermeasures
ECS	Environmental Control System
EDC	Electrical Distribution Center
EIU	External Interface Unit
EME	Electromagnetic Environment
EMI	Electromagnetic Interference
EO	Electro-Optic
EPA	Environmental Protection Agency
ER	Established Reliability
FAADS	Forward Area Air Defense Systems
FABTOC	Field Artillery Battalion Tactical OC
FD	Failure Definition
FDC	Fire Direction Center
FD/SC	Failure Definition and Scoring Criteria
FH	Frequency hopping
FIPS	Federal Information Processing Standard
FL	Fault detection and Locating

FLIR	Forward Looking Infra-Red
FO	Forward Observer
FOV	Field-Of-View
FRAGO	Fragmentary Order
FSD	Full Scale Development
FSE	Fire Support Element
GCDP	Gunner’s Control and Display Panel
GCH	Gunner’s Power Control Handle
GCHA	Gunner’s Control Handle Assembly
GFB	Government-Furnished Baseline
GFE	Government-Furnished Equipment
GHz	Gigahertz
GLD	Ground Laser Designator
GLLD	Ground Laser Locator Designator
GPS	Global Positioning System
GPSE	Commander’s GPS extension
GTDB	Generic Terrain Databases
GVW	Gross Vehicle Weight
HEI-T	High-Explosive Incendiary with Tracer
HEMTT	Heavy Expanded Mobility Tactical Trucks
HFE	Human Factors Engineering
HMMWV	High Mobility Multipurpose Wheeled Vehicle
HOPSET	Frequency Hopping Mode
HWCI	Hardware Configuration Item
Hz	Hertz
IAW	In Accordance With
IC	Initial Conditions
ICU	Image Control Unit
ICWS	Improved Commander’s Weapon Station
IEEE	Institute of Elec. & Electronics Engineers
IG	Image Generator
IOAC	Infantry Officer Advance Course
IOBC	Infantry Officer Basic Course
IPU	Internal Processing Units
ISO	International Standards Organization
IST	Institute for Simulation and Training
ISU	Integrated Sight Unit
ITD	Interim Terrain Data
IVIS	Inter-Vehicular Information System
IV&V	Independent Verification & Validation
KPa	Kilopascal

LAN	Local Area Network
LCD	Liquid Crystal Display
LD/R	Laser Designator/Rangefinder
LED	Light Emitting Diode
LHN	Long Haul Network
LOSAT	Line of Sight Anti-Tank
LRF	Laser Range Finder
LRU	Lowest Replaceable Unit
MATES	Maintenance Training Equipment Sites
Mb	Megabytes
MBC	Mortar Ballistics Computer
MCC	Master Control Console
MCLIC	Mine Clearing Line Charge
M-COFT	Mobile Conduct Of Fire Trainer
MIJI	Meaconing, Intrusion, Jamming, & Interference
min	Minute
MLRS	Multiple Launch Rocket System
mm	Millimeters
MMAX	Maximum-Repair-Time
MNOBF	Mean Number of Operations Between Failure
MODSIM	Modular Simulator System Program
MOS	Military Occupation Specialty
MOUT	Military Operations in Urban Terrain
MP	Mission Profile
MPIM	Multi-Purpose Individual Munitions
MRS	Muzzle Reference Sensor
MSS	Modular Simulator System
MSW	Maximum Shipping Weight
MTA	Major Training Area
MTBF	Mean Time Between Failures
MTP	Mission Training Plan
MTTR	Mean-Time-To-Repair
NAVAIRSYSCOM	Naval Air Systems Command
NAVTRASYSCEN	Naval Training Systems Center
NCO	Non-Commissioned Officer
NCS	Net Control Station
NDI	Non-Development Item
NFPA	National Fire Protection Association
NG	National Guard
NIOSH	National Inst. of Occupational Safety & Health
NLOS-F	Non Line Of Sight - Forward
NSG	North Seeking Gyrocompass

NVV	Night Vision Viewer
OC	Operation Center
OCONUS	Outside Continental United States
OLP	Optical Line Pair
OPFOR	Opposing Force
OPSEC	Operational Security
OSHA	Occupational Safety & Health Agency
P^3I	Preplanned Product Improvement
PCC	Precommand Course
PCO	Procuring Contracting Officer
PCU	Power Control Unit
PDU	Protocol Data Unit
PEI	Protocol Engines Incorporated
PEL	Permissible Exposure Limit
PIDS	Prime Iten Development Specification
PLGR	Precision Lightweight GPS Receiver
PM	Performance Monitoring
PPE	Personal protective equipment
PPQT	Preproduction Qualification Test
PPS	Portable Power System
PS	Personnel Support
PVC	Polyvinylchloride
PVD	Plan View Display
RAG	Regimental Artillery Group
RC	Reserve Component
REL	Recommended Exposure Limits
RF	Radio Frequency
RIU	Radio Interface Unit
RPM	Revolutions Per Minute
RTO	Radio Telephone Operator
SADARM	Sense And Destroy Armor
SAE	Society of Automotive Engineers
SAF	Semi-Automated Forces
SAW	Squad Automatic Weapon
SHORAD	Short Ranged Air Defense
SIMNET	Simulation Network
SINCGARS	Single Channel Grnd. & Airborne Radio Sys.
SNR	Signal-to-Noise Ratio
SOA	Safe Operating Area
SPS ……….	Standard Positioning Service
SSDB	Standard Simulator Database

SSDD	System/Segment Design Document
SSS	SAF Software Simulation
STRICOM	Simulation, Training and Instrumentation Command
TAC	Tactical Air Command
TACMS	Tactical Missile System
TACP	Tactical Air Control Party
TAMMS	The Army Maintenance Management System
TBD	To Be Defined
TCCAT	Third Class Combined Arms Training
TCH	Commander’s power control handle
TEU	Thermal Imaging Control Unit
TGW	Terminal Guidance Warhead
THD	Total Harmonic Distortion
TIREM	Terrain Integrated Rough Earth Model
TIS	Thermal Imaging System
TLV	Threshold limit values
TOC	Tactical Operations Center
TOW	Tube launched, Optically Wired-Guided
TRA	Tire and Rim Association
TRU	Thermal Receiving Unit
TSCD	Targeting Station Control Device
TSHR	Trainer System Hardware Resource
TSPR	Trainer System Processing Resource
TSS	Trainer System Software
TSSE	Trainer System Support Environment
TUE	Trainer Unique Equipment
UI	User Interface
UL	Underwriters Laboratories
UMCP	Unit Maintenance Collection Point
USAR	United States Army Reserve
UTES	Unit Training Equipment Sites
UTM	Universal Traverse Mercator
V	Volts
VAC	Volts, Alternating Current
VDC	Volts, Direct Current
WIA	Wounded in Action
WP	White Phosphorous

APPENDIX A
VISUAL SYSTEM FOR THE CLOSE COMBAT TACTICAL TRAINER

10. SCOPE.

This appendix establishes the majority of the requirements for the image generation and display systems for the CCTT. It forms a part of the Prime Item Development Specification for the Close Combat Tactical Trainer system and is to be interpreted the same as if it were embedded in the specification as 3.7.5 and subparagraphs thereto.

20. APPLICABLE DOCUMENTS.

Unless otherwise specified, the following specifications, standards, handbooks, and other Non-Government documents form a part of this specification to the extent specified herein, to the exact issue identified by the Document Summary List.

20.1 Government documents.

SPECIFICATIONS:

Military

MIL-T-89301 - 1:50,000 Scale Topographic Maps of Foreign Areas

OTHER PUBLICATIONS:

DeFENSE Mapping Agency

PS/3AG/201 - Product Specifications for Topographic Maps: 1:100,000 Scale

PS/1AE/201 - Product Specifications for Joint Operations Graphics Series 1501 and Series 1501 Air: Scale 1:250,000

(Copies of specifications, standards, drawings, and publications required by suppliers in connection with specific procurement functions shall be obtained from the procuring activity or as directed by the Procuring Contracting Officer (PCO).)

30. REQUIREMENTS.

30.1 Item definition.

The image generation and display systems shall consist of the computer image generation equipment, display devices and associated software required to simulate the CCTT visual scene environment. The visual scene environment shall be seen through the vision blocks, sights, sensors and popped hatch of the CCTT modules and on the visual displays associated with selected CCTT consoles.

The following CCTT modules and consoles are covered by this appendix:

a. Modules:

(1) M1A1/M1A2 tank.

(2) M2A2/M3A2

(3) M981 Fire Support Team Vehicle.

(4) M113A3 Armored Personnel Carrier.

(5) High Mobility Multipurpose Wheeled Vehicle (HMMWV).

(6) Dismounted Infantry.

b. Consoles with visual displays:

(7) After Action Review (AAR).

(8) Tactical Air Control Party (TACP)

Throughout this appendix the term “host” shall be understood to mean the local host associated with each module/console.

30.1.1 Interface definition.

The interface between the local module/console host computer and image generation system shall provide a clean separation of visual functions and host functions.

30.1.1.1 Mechanical interface.

The mechanical interface shall include all mechanical structures for housing the various components for the visual systems and structures to properly position and support the components. For each module, light-tight shrouds or similar means shall be provided so that extraneous light from outside the module doesn’t degrade visual display system performance.

30.1.1.2 Electronic interface.

The electronic interface shall provide all of the data, power and control interfaces required to achieve the complete performance and functionality specified for the CCTT system.

a. A compatible data transfer and control interface interconnecting each module’s/console’s image generation system and local host computer system shall be provided. The interface shall provide necessary control signal generation, timing, logic level shifting, signal buffering, etc. as required for proper image generator system operation. The interface between the image generation system and the local host computer shall utilize a common, standard commercial or military interconnect and shall observe standard communication protocols.

b. Proper integration of the electrical power for simple and safe operation of the system is required.

30.1.1.3 Software interface.

The software interface shall include the software necessary to properly integrate each module’s/console’s host and image generation systems in order to provide the complete performance specified for the CCTT system.

30.1.2 Major component list.

The major visual system components for each module/console shall be as specified below with the only exception being the image database development system which is a stand-alone system delivered with each TSSE.

30.1.2.1 Image generator subsystem.

The image generation subsystem shall provide imagery for the simulation of all of the display types listed in 30.1.2.2 as applicable to each individual module/console. The image generation subsystem shall provide, as a minimum, the following functions:

a. Host Processor Interface.

b. Local database storage including terrain, features and models.

c. Real time scene content management.

d. Image processing.

e. Display processing.

The system shall provide visual environment feedback data to the host.

30.1.2.2 Image display subsystems.

The image display subsystems shall convert the signals from the image generator into visual images which depict the appearance of the physical environment. The image display subsystem shall include the following display types as applicable to each individual module/console:

a. Vision blocks.

b. Weapon sights and periscopes (with magnification).

c. Thermal imagery systems.

d. Light intensification devices.

e. Console visual displays.

f. Popped hatch, Dismounted Infantry, and HMMWV displays.

g. Binoculars.

30.1.2.3 Image database development system.

An integrated system of hardware and software capable of generating and modifying databases shall be provided.

30.1.2.4 Image database.

The CCTT visual system shall utilize a stored digital representation of the training environment's physical characteristics, vehicles, military units and special effects.

30.1.2.5 Operating and maintenance software and hardware.

All software and hardware needed to efficiently operate and maintain the system shall be provided.

30.1.3 Not used.

30.1.4 Not used.

30.2 Characteristics.

NOTE: See paragraph 30.3.3 herein for important design constraint information.

30.2.1 Performance.

The Image Generation and Display System for each module/console shall provide real-time visual and sensor displays of the training environment for all simulated viewpoint positions and attitudes. The computer image generator imagery shall change with and be dictated by real-time movement through the environment, engagement actions taken, and the actions of all modules and consoles in the battle scenario. All objects in the three dimensional environment shall have the correct projected size, shape, color, location, and brightness relative to the design viewpoint, magnification, sensor response and Field of View (FOV). The computer image generator computations shall be based upon a stored numerical representation of the training environment. The system shall provide visual and sensor information concerning the environment, other units and events relevant to the tactical exercise and weapon system operation as would be available under the corresponding real world conditions. Sufficient detail shall be available to provide this information and to provide realistic depth perception over terrain surfaces. System performance shall not be limited in any way except as specified herein and all of the specified performance and characteristics shall be available simultaneously unless otherwise specified. The visual system shall respond to simulation events from the host.

30.2.1.1 Functional training capabilities.

The CCTT shall be capable of training military units in crew and collective skills for command and control, tactical navigation, movement, coordination of fire, and weapons systems operation in the full range of environmental and tactical conditions which exist in the real world areas being simulated. The system shall provide visual scenes adequate for employing all standard military tactics for the full range of battle and environmental conditions.

The system shall enable performance in the same manner using the same information available in the corresponding operational situation. Altered task performance is considered a serious degradation of training and shall only be allowed in situations for which no reasonable alternative exists and only with prior specific approval of the Procuring Contracting Officer (PCO).

A continuous visual scene shall be provided for unprogrammed movement throughout the entire visual environment. The following general capabilities shall be provided to the same extent they would exist in the real world under the conditions being simulated:

a. Ability to see all other units, targets, and tactically significant objects and effects.

b. Ability to be seen by all other units.

c. Ability to hide from the view of other units and use cover and concealment.

d. Ability to move through the environment in the same way and with the same constraints as in the real world.

e. Ability to modify the appearance (but not necessarily the geometry) of the environment in response to tactical excavations (defilade positions), shell craters (created by engineering operations, artillery cratering missions, and FWA cratering missions) which serve as obstructions to movement, breached minefields and the destruction of bridges.

30.2.1.1.1 Not Used.

30.2.1.1.2 General training scene requirements.

Training scenes shall be provided for all visual displays when the visual asset is in use by the operator. Training scenes shall be consistent with the real-world environment being depicted with features and characteristics such as mountains, desert, swamp, rolling hills, farmland, towns, streams, lakes, ponds, hilltops, valleys, saddles, ridges, depressions, gullies, streams, trails, hillocks, mountains, rivers, fords, forests, roads, man made structures, representative vegetation, and etc., being similar to the real-world area in appearance, frequency of occurrence and other characteristics. Training scene features must be displayed with sufficient fidelity to allow 95 percent of the users to recognize them by shape, size, relationship to other objects, and texture.

30.2.1.1.2.1 Environment complexity.

The complexity of the visual environment shall be sufficient to provide the same influence on tactics and their effectiveness as in the real world. Realistic cover and concealment, realistic constraints, and realistic effects of meteorological conditions shall be provided as in the real world. Urban areas with a high density of buildings shall be represented but a simplified representation is acceptable, i.e., use of fewer buildings which are textured so as to appear as many. Small urban areas shall be represented by no less than 20 separate buildings. As appropriate, rural areas shall include regions of dense vegetation in which the range of vision is extremely limited and the terrain is not passable by all types of units; regions of moderately dense vegetation such as agricultural areas with fence rows, scattered wooded areas, etc. which typically limit vision to short ranges; and open terrain with very little tall vegetation and vision limited primarily by terrain shape. The degree of concealment for each type of unit shall be the same as would be provided in the real world for that type of cover and unit. All features of the environment which offer cover, restrict movement or otherwise affect the tactical situation shall be visible to the same extent as in the real world. The terrain for the visual environment shall be a polygonal skin which is defined by three levels of resolution: coarse, medium and high. The coarse resolution skin shall cover 77 percent of the gaming area and shall be derived from DMA DTED level 1 or level 2 data, with the resulting terrain fidelity equivalent to, or better than, level 1 data. The medium resolution skin shall cover 20 percent of the gaming area and shall be subdivided into regions located throughout the gaming area as directed by the Government during the visual database reviews. This medium skin shall provide terrain roughness which is equivalent to the roughest terrain that can be represented by DMA DTED level 2. The high resolution skin shall cover 3 percent of the gaming area and shall be subdivided into terrain features (berms, river banks, etc.) which are located throughout the gaming area as directed by the Government during the visual database reviews. This high resolution skin shall provide those terrain roughness characteristics which are so fine (e.g., trails, berms, gullies, river banks) that in most cases they aren’t even represented on a 1:50,000 map. The high resolution skin shall be used to represent terrain features as small as .5 meter.

30.2.1.1.2.2 Range of vision.

The range of vision shall be the same as in the corresponding real world situation except where limited by the system resolution and the specified visible range (active radius). Each eyepoint shall have a visible range of 4000 meters (minimum acceptable value) for surrounding terrain and objects on the terrain with the only exceptions being prominent navigational and tactically significant landmarks which shall be visible out to 20 km.

30.2.1.1.2.3 Vehicle simulation.

The environment shall influence the use and appearance of vehicles as in the real world. The displayed images shall depict the speed, path and attitude of the simulated vehicle using vehicle dynamics calculations from the host. The movement of units shall be correctly influenced by the terrain slope, surface material (soil type), and water depth, so that the same limitations on motion exist as in the real world. The dynamics of the moving parts on vehicles, e.g., turret, tube and cupola, as appropriate, shall be depicted. The displayed images shall depict operation of weapons system stabilization and tracking systems. The simulated vehicles shall be capable of being placed anywhere in the gaming environment at initialization. The movement and function for the vehicles shall be controlled by the host. For “manned” vehicles and those vehicles under direct Operations Center control, the host shall respond to trainee/operator actions at the modules/consoles. For SAF controlled vehicles the host shall respond to the dictates of SAF.

30.2.1.1.2.4 Ground-to-air-combat.

The CCTT visual system shall provide visual scenes for ground unit engagement of air targets. Displayed images shall include all of the aircraft types specified in Table A-1. Weapons employment by and against aircraft shall be depicted. Ground to air guided weapons flight, and weapons bursts on or near the target shall be depicted. When aircraft are hit by ground based weapons, a weapons effect consistent with the type of weapon and its point of impact or detonation shall be provided.

30.2.1.1.2.5 Ground missile combat.

The CCTT visual system shall provide displayed images of the engagement of simulated vehicles by ground launched missile systems. The visual system shall depict missile rocket motor launch signature, gunner’s sight obscuration after launch, guided missile flight (using a generic missile model), and weapons burst on or near the target. When a ground target is hit, the displayed image shall present the appropriate weapons effect and kill indication. Ground engagements shall be visible to those units for which either the attacking unit, the attacked target or both are within their visibility limits.

30.2.1.1.2.6 Ground mounted combat.

The CCTT visual system shall generate, in real-time, displayed images of the simulated battlefield which depict the movement and engagement of all stationary and moving vehicles (friendly and enemy), including dismounted infantry, whether in the open or partially concealed.

30.2.1.1.2.7 Ground dismounted combat.

The CCTT visual system shall portray the movement and maneuver of dismounted infantry units. The dismounted infantry units shall appear as described in paragraph 3.7.10. The appearance of the soldier icon shall be a function of the type of cover present and the stance. Movement of the dismounted infantry shall be controlled by a squad leader, platoon leader or forward observer from the respective station within a DI module. Capability for the infantry to dismount and remount shall be provided. Engagement (utilizing appropriate infantry weapons) with hostile vehicles and fire fights with hostile dismounted infantry shall be provided. Deployment and recovery of dismounted infantry units shall be to and from appropriate vehicles. Vehicles used by the infantry shall be simulated to the same extent as other vehicles specified herein.

30.2.1.2 Special real-time processing.

The image generator shall have the capability to provide high-fidelity simulation of atmospheric and meteorological effects, illumination conditions, special light characteristics and tactical smoke. The specified effects and conditions shall be realistically reflected in the simulation of all imagery.

30.2.1.2.1 Atmospheric and meteorological effects.

Simulation of atmospheric and meteorological effects shall be provided. The attenuation of light by the atmosphere due to clouds, fog, rain and haze shall be simulated. Each atmospheric and meteorological effect shall be controllable from the MCC.

30.2.1.2.1.1 Ambient visibility (haze).

The attenuation of light by the atmosphere in areas not occupied by other obscurants shall be simulated as haze. The nominal visibility for the haze shall be adjustable from zero to 20.0 km in increments of 0.5 kilometers or less. The obscuration of scene elements as a function of range shall be modeled from real world characteristics except as necessary for short periods of scene management. The variation of haze with altitude shall be included for line of sight fading of air targets.

30.2.1.2.1.2 Fog simulation.

A fog area extending from the ground to an altitude of 2000 feet (selectable from the MCC in 5 foot increments for the first 50 feet, 50 foot increments from 50 to 500 feet, and 500 foot increments for the remainder) shall be simulated. The visibility reduction due to fog shall be proportional to the line of sight range through the fog to each point in the scene. Fog density shall be adjustable (0-2000 meters minimum) in 50 meter increments or less. The maximum fog range setting shall remove all fog effects.

Fog shall be modeled as having a distinct white hue.

30.2.1.2.1.3 Cloud simulation.

An overcast sky with obscuration of objects above the cloud base shall be simulated. The appearance of a cloud layer shall be simulated by an appropriate image (pixel) data or texture. Ceiling height shall be selectable from 0 to 10,000 feet in 100 foot increments or less.

30.2.1.2.1.4 Rain simulation.

The visibility attenuation due to rain shall be simulated. On/off control of rain shall be provided.

30.2.1.2.1.5 Not used.

30.2.1.2.1.6 Sky and horizon.

A sky and horizon shall be provided. The unfaded sky color shall be blue. The sky brightness and color shall vary as a function of visibility effects and illumination from blue to shades of grey. The dusk and dawn horizons shall be simulated as a lower intensity grey with an orange glow on the east or west horizon respectively and shall be selectable.

30.2.1.2.1.7 Not Used.

30.2.1.2.2 Illumination.

The illumination of the visual scene by both natural and artificial sources shall be simulated. The total illumination shall be a combination of directional and diffuse illumination. The ratio of directional to diffuse illumination shall be correct for the illumination source being simulated. Natural illumination shall contain sufficient directionality to reveal the shape and orientation of objects. The ratio of directional to diffuse illumination shall be a readily programmable constant for sources which contain both.

30.2.1.2.2.1 Time of day.

Automatic, gradual illumination changes to simulate continuous time of day shall be provided. The time of day illumination shall represent, at minimum, day, overcast day, dawn and dusk, moonlit night, and starlit night. Additional night illumination appropriate for night vision light intensification devices shall be provided. Appropriate adjustments in contrast, color, and intensity of objects shall occur in the displayed image to depict the selected time of day. The intensity and position of the illumination source shall be represented.

30.2.1.2.2.2 Artificial illumination.

30.2.1.2.2.2.1 Flare illumination.

Falling flares shall be simulated as an overhead illumination source at the appropriate location and altitude. Both the flare (if located in the FOV) and the illumination it provides shall be depicted in the visual scene. Flare locations shall be fixed by grid coordinates provided through the Fire Direction Center, FIST-V or Field Artillery Battalion Tactical Operations Center and preprogrammed direction set in the system at the beginning of the scenario. Two types of flares, the illumination round for the 120mm mortar and the M485A2 illumination round for the 155mm Howitzer shall be selectable. Brightness, intensity, area illuminated and burn time shall be representative of the type of flare simulated. Multiple flares may be represented as a composite flare with a single flare source and attached light points. The system shall support at least two simultaneous single or multiple flares. Location of flares and its illumination shall be restricted to the range limitations of the weapon system firing and the flare's own characteristics.

30.2.1.2.2.2.2 Light points.

A variable intensity light points capability shall be provided and used as directed in database reviews.

30.2.1.2.2.2.3 Light point intensity control.

Each light point group intensity level shall be individually programmable.

30.2.1.2.3 Tactical smoke.

The use of tactical smoke for screening, silhouetting, and blinding shall be simulated. The simulation shall include the appropriate effects for different delivery systems (e.g. grenade), appearance, dissipation time, growth, size, shape, vision impairment, Infra-Red (IR) shielding, and target silhouetting. For tactical smoke, the temporal effects of growth and dissipation can be predefined. The smoke of the visual and sensor scenes shall be simulated with different transmittances appropriate to the scene display mode, i.e., visible, image intensification, and thermal. The laser range finder shall be appropriately degraded due to smoke through such techniques as “screen door” transparency.

30.2.1.2.4 Visual simulation of motion.

Visual simulation of own-vehicle (shall be understood to include the DI, TACP, and AAR eyepoints) and visual scene element motion shall be as follows:

30.2.1.2.4.1 Own-vehicle dynamics.

Visual simulation shall provide own-vehicle motion equal to the complete range of motion capability of the design basis craft along and about all axes without any degradation in scene content or scene quality unless otherwise specified. The motion effects shall be applied to the visual simulation associated with each own-vehicle eyepoint.

30.2.1.2.4.2 Moving/repositionable/switchable models.

The image generator shall be capable of displaying a combination of dynamic and static models, as appropriate, to simulate the full complement of vehicles (tanks, aircraft, etc.), dismounted infantry, weapons, buildings and bridges (intact and rubbled versions), defilade positions, breached minefields, and smoke required as part of the CCTT trainer system. This shall include multiple versions of each model as dictated by the requirement for model level-of-detail and damage assessment. Dynamic models shall have unrestricted movement in six-degrees of freedom. Dynamic models representing vehicles with moving parts shall have articulated components which move in response to actions taken by operators/trainees in the associated modules/consoles. It shall be possible to reassign the moving coordinate systems to different displayed objects during a simulation as needed. The dynamic coordinate sets used for moving models shall be assigned to specific models in real time. A method shall be provided to specify priority for dynamic coordinate set assignment based on modeler input, range and state of model activation. The selection of priorities shall be subject to approval during design reviews of the contract. Ground vehicles shall follow the contour of the terrain, as commanded by the local host computer. Air vehicles shall follow flight paths computed by the related vehicle consoles. The system must simultaneously support all the positioning, environment feedback and display processing associated with columns I, II and III.

	I In Active Area For each	II Displayed Per Module/Console	III Displayed Per Channel
Vehicles	150	100	20
Immobilized Vehicles	50	35	10
In-flight missiles/Projectiles	35	20	5
Animation and Special Effects	35	20	5
Misc. Relocatable Objects	20	10	5
Tactical Smoke	15	7	3

The above listed quantities define a specific, nominal test situation which the module's/console's system shall be able to accommodate. A scene management process shall be provided to allow real-time reallocation of processing resources to accommodate other combinations of entities.

Clarifications for column II:

a. These quantities are based on an idealized module/console which is simultaneously displaying a composite 360 degrees of instantaneous HFOV. The required models for each module/console is the ratio of the composite HFOV to the idealized HFOV. The composite HFOV shall be understood to be the sum total of the instantaneous HFOV (use true HFOV for magnified images) for all simultaneously active displays (shall be based on worst case situation regarding simultaneously active displays).

Where the composite HFOV for a particular module/console is more or less than 360 degrees, the quantities shall be prorated accordingly but shall in no case be less than the column III values. An example for the M2A2 module:

	HFOV
POPPED HATCH	180
DRIVER	160
GUNNER	15 (NOTE: USE TRUE FOR FOV FOR MAGNIFIED MAGES)
COMPOSITE	355

Therefore the required quantities for this module would be decreased by a factor of 355/360.

b. For the "vehicle" category 75 percent are in motion, 50 percent are at their highest level of complexity (i.e., polygon count and dynamics (six DOF for hull and up to three articulated parts)), 25 percent are at medium level of complexity and the remaining are at the lowest level of complexity.

c. For the "immobilized vehicle" category, 35 percent still have articulated components.

30.2.1.2.4.3 Animation and special effects.

30.2.1.2.4.3.1 Propeller/Rotor disc.

A translucent disc for all aircraft with propellers (rotors) shall be displayed in the scene.

30.2.1.2.4.3.2 Visible weapons effects.

All visible effects of weapons originating from friendly and hostile military units on targets, terrain and features, within the visual simulation range shall be visually depicted. These weapon effects shall include muzzle flash, rocket plume, smoke, temporary vision obscuration, tracers, projectile flight (for guided, self propelled weapons), weapon impact, and detonation when applicable. Regardless of firing platform location, when a weapon impacts on targets, terrain, or features and said impact is within both the FOV and detection limits of active eyepoint(s), the corresponding weapons impact effect shall be visually depicted for all such eyepoints (the only exception to this is that small arms fire impacts may be grouped into a composite impact for automatic weapon's fire). Both transient and permanent weapons impact effects shall be depicted. Transient weapons effects shall depict bursts on terrain or target vehicle hits.

Permanent weapon impact effects shall result in the depiction of the computed result of the weapon damage to the general use models as defined in Table A-1, and buildings and bridges. The weapon effect simulation shall be such that misregistration between the effect and the associated point of origin, the coordinates for the weapon in flight and the impact point shall not be discernible by the observer.

30.2.1.2.4.3.2.1 Air-to-ground weapon effects.

Weapons employment by aircraft shall be depicted (Air-to-ground weapons). Air-to-ground weapons flight (for guided, self propelled weapons), and weapons bursts on or near the target shall be depicted. Air-to-ground weapons effects consistent with the type of weapon and its point of impact or detonation shall be provided.

30.2.1.2.4.3.2.2 Weapons fire and weapons impact effect.

There shall be weapons fire effects (i.e., muzzle flash, tracer, missile launch, laser designation of target, etc.) and weapons impact effect visually depicted for all weapons (enemy and friendly) in the CCTT system. All weapons fire effects originating from friendly and hostile military units within the visual simulation range shall be visually depicted in response to the appropriate firing data and degree of lethality.

30.2.1.2.4.3.2.2.1 Tracer simulation.

The CCTT visual system shall display simulated weapon system tracers for all weapons in the CCTT system having a tracer capability. The tracer simulation shall be consistent with the weapon being fired and shall realistically represent the rate of fire. For tracers originating from weapons attached to a given simulator module, the proper tracer trajectory and occultation shall be visually displayed for the crew stations of that module (i.e. Ownvehicle Tracers). A simplified tracer simulation for tracers generated by weapons external to the simulator module (i.e. Crossing Tracers) shall be provided for up to four weapons per firing platform model. The simplified simulation shall have a predefined, simplified trajectory and no support for collision with other objects.

30.2.1.2.4.3.3 Dust trail.

The effect of the dust trail generated by ground vehicles when and only when traversing dry dirt or sand areas shall be visually simulated. The effects of vehicle type and direction of movement (forward and reverse), variation in transparency, general appearance, and size with the size being based on vehicle speed shall be included in the dust trail simulation. A minimum of five sizes of dust trail shall be provided; three for forward motion and two for reverse motion with the size being based on vehicle speed.

30.2.1.2.5 Special geometric computations.

The following requirements apply to computations of the location, orientation, positioning, and dynamics of own-vehicle, models (tanks, weapons, etc.) and special effects relative to, and as affected by, the terrain surface and objects on the terrain. The results of the computation are generally data for animation or data needed by the host for computations which must be based on the image database to ensure correlation of all simulation components.

30.2.1.2.5.1 Simulated position.

The image generator shall generate an image that is positioned within the following computational tolerances. These tolerances are with respect to the position inputs from the local host that are supplied to the visual system for own vehicle, models and special effects.

a. Simulated angular position for all axes: +/- 0.04 degree.

b. Simulated altitude: +/- 1.0 cm.

c. Simulated North-South and East-West position: +/- 2.0 cm.

d. Moving object simulated angular position for all axes: +/- 0.05 degree.

e. Moving object simulated altitude: +/- 1.0 cm.

f. Moving object simulated North-South and East-West position: +/-2.0 cm.

g. Surface elevation: +/- 1.0 cm.

30.2.1.2.5.2 Visual environment feedback.

The visual system shall compute the information listed below and report the results to the host or provide sufficient information for the host to perform the calculations internally without real-time feedback from the visual system.

30.2.1.2.5.2.1 Surface contact and soil type.

The attitude of all visible land vehicles shall reflect the terrain surface shape and orientation based on the elevation at a minimum of three support points as defined in the terrain database. For own-vehicle a number of contact point elevations and underlying soil types shall be tested and reported to the host sufficient to meet the vehicle dynamics requirements for the type vehicle. To be consistent with the Interim Terrain Data (ITD) a minimum of 20 different soil types shall be available for use in defining the terrain surface. The own-vehicle dynamics computations shall utilize the soil type as one of the parameters affecting traction and trafficability. Own-vehicle attitude shall reflect the surface orientation.

30.2.1.2.5.2.2 Collision detection.

All collisions of own-vehicle with any and all predefined collision volumes in the database shall be determined by the host for use as one of the parameters influencing vehicle movement. All three dimensional objects in the database large enough to influence vehicle movement shall have associated collision volumes. Objects in close proximity to own-vehicle shall be tested each display field to determine if any collisions have occurred. A minimum of 10 collision detection test points on own-vehicle, located as determined by the Government in database reviews, shall be included in each collision detection test. Collision/Crash conditions shall be detected and indicated via the host within 0.5 seconds of occurrence. Errors in detecting collision shall not exceed .5 meter.

30.2.1.2.5.2.3 Weapon impact detection.

All weapon trajectory impact points shall be determined by the host to establish impact location and trigger the resulting weapon impact simulation.

30.2.1.2.5.2.4 Laser range finder.

The visual system shall compute the range for the laser range finder simulation and return it to the host every other update period. The laser range finder computation shall be based on the look direction designated by the host and the intersection of the associated line of sight with visual environment polygons. The laser range finder simulation shall address the effect of obscurants (i.e. tactical smoke) on the range finders performance (through such techniques as “screen door” transparency).

30.2.1.2.5.2.5 Line of sight.

When commanded by the host, the visual system shall determine whether or not line of sight conditions exist between ownship and any designated point and return the determination to the host within four update periods. Only points within an active viewport can be designated.

30.2.1.2.5.3 Gaming area.

The gaming area for the primary environment shall be defined by a training environment of at least 100 km by 150 km. The visual system shall accommodate terrain databases of at least 100 km by 150 km. Throughout the gaming area, transitions between active areas shall be transparent to the operator.

30.2.1.3 Image quality, general.

The CCTT system when integrated with the visual system shall provide the performance specified below. The performance specified applies to the total contributions of all parts of the complete integrated system.

There shall not be any variations or degradation in brightness, color, sharpness, position, or other visual characteristics which are not typical of the scene being simulated except as specified.

30.2.1.3.1 Visual image field of view.

The true field of view for each design eyepoint and the associated sights, sensors, vision blocks and direct view displays shall be as specified for each manned module/console.

30.2.1.3.2 Visual image sharpness.

Displayed image sharpness shall be measured with a test pattern with multiple sets of alternate, equal width dark and light bars (50 percent duty cycle) modeled after the 1951 USAF Resolution Test Chart and generated by the image generator. In each set of resolution bars, one set of bars shall be parallel to the raster lines and the other perpendicular. The test pattern shall contain a minimum of five cycles of resolution bars to cover the entire range of resolution to be measured (one cycle of resolution bars will cover a 2:1 range of resolution). The test patterns shall be generated in exactly the same manner as the graphics imagery used for training. The pattern shall be easily relocatable throughout the FOV and movable in increments of less than one-quarter pixel around the test positions. The modulation transfer function shall be at least 10 percent when viewed on the display, from the nominal eyepoint locations for all positions of the test pattern. The term optical line pair (OLP) in the following paragraphs shall be defined as one light and one dark bar in the test pattern within the FOV. The specific image sharpness requirements of Appendix A are based on the use of reasonably effective anti-aliasing and a Kell factor of 0.7. The ratio of vertical to horizontal resolution (in arc-minutes/OLP) shall vary no more than 0.8 to 1.2. Image motion of up to 15 degrees per second shall not degrade sharpness by more than 20 percent.

30.2.1.3.2.1 Surface resolution.

Surface resolution shall be determined based on a test pattern of alternate, equal width, dark and light bars (50 percent duty cycle). Resolution is the test pattern spacing at which the Modulation Transfer Function (MTF) is 10 percent viewed on the display and including all system elements including image generator, display device and intervening optics and measured in Arc-minutes/Optical Line Pair [One dark bar and one light bar constitute an Optical Line Pair (OLP)]. Multiple sets of alternate light bars and dark bars each shall be provided in the pattern with the sets perpendicular to each other as in the standard 1951 USAF resolution chart. One set shall be parallel to the raster lines.

30.2.1.3.2.2 Light point resolution.

The light point resolution shall be the same as surface resolution and shall be computed as the average spacing between light point centers in an almost merged, 40 X 40 array of anti-aliased light points. The term almost-merged array is defined as being analogous to the 10 percent MTF specified for surface resolution and the lights points are readily discernible as separate rows and columns. All measurements shall be in arc-minutes.

30.2.1.3.3 Luminance.

Luminance shall be no less than 3.5 foot Lamberts (ft-L) at the center of each display channel with the only exception being direct view CRT monitors which shall be no less than 20 ft-L. Luminance shall be tested with a white polygon displayed at the maximum simulated illumination. The polygon shall be generated and displayed using the visual simulation processing normally used for training. The polygon shall be normal to the illumination direction, illuminated under the average brightest sunlight conditions without atmospheric attenuation. The requirement shall apply to all locations within the viewing volume specified and shall include the effect of all viewing optics, windscreens, etc. Luminance shall be determined as the average luminance for a uniform array of test points. Local “hot spots” shall not be used for the measurements at the test points. For other than direct view CRT’s luminance is specified for a 20 percent duty cycle, where duty cycle is the percentage of the channel area which is illuminated. The 20 percent duty cycle requirement shall be met with a continuous, rectangular illuminated screen area with the long dimension parallel to the raster lines. For direct view CRT monitors a full-screen white surface test pattern shall be used to measure the above specified luminance. Measurements shall be made from the design eye location of each display through all intervening optics.

30.2.1.3.3.1 Luminance variation.

Luminance drift shall not exceed +/- l0 percent over a continuous 16 hour operation period for any selected time of day simulation. Initial measurements shall be taken after a 45 minute warm-up (only exception: 15 minutes for direct view CRT monitors) and adjustment period. Luminance shall be uniform to within +/- 50 percent of the central area luminance over the entire vertical and horizontal FOV for each display channel. Luminance shall be uniform to within 20 percent across boundaries of similar adjacent displays. Luminance at each point in the display shall not vary by more than 20 percent (only exception: 10 percent for direct view CRT monitors) when viewed from any two points within the specified viewing volume. The system shall maintain a minimum of 50 percent of the specified peak luminance for a minimum of 2000 hours of operation without replacement of any display component.

30.2.1.3.4 Contrast.

The minimum contrast ratio for all displayed images shall be 10:1 (only exception: 20:1 for direct view CRT monitors) for each display channel and throughout the viewing volume and FOV using a checkerboard test pattern (all displays illuminated with the test pattern simultaneously). The pattern must provides at least 16 squares per display channel with 50 percent of the squares at the specified maximum luminance. The test pattern shall be generated using the same type scene model (developed by the same methods) and image processing as is used for training. Measurements shall be made through all intervening optics.

30.2.1.3.5 Color.

The visual imagery shall provide an approximation of the full visible color spectrum as limited by commercial color display monitors. In the database, not less than 128 colors, each capable of being a different hue, shall be available for polygon and object color definition. The 128 colors shall be selectable from a set of not less than 4096 colors. For thermal (IR) and image intensifier simulation, the 128 levels shall be capable of representing 128 different intensity values out of a set of 4096. At the output, not less than 256 intensity levels of each color primary shall be provided.

30.2.1.3.5.1 Color processing.

Luminance and chrominance information processing shall be accomplished with sufficient resolution and accuracy to ensure stable, continuous, color at the display with no discernible abrupt transitions and mach banding except as demanded by the phenomena being simulated. The image generator design shall also preclude visible instantaneous changes in color and intensity due to changes in fading and shading as the eyepoint moves through the scene. Color and intensity computations shall use algorithms which correctly account for the physical phenomena being simulated. The computed color and intensity shall be a function of reflectance, luminance, illumination magnitude and direction, range and atmospheric effects. The computer image generator design shall account for video bandwidth, Signal-to-Noise Ratio (SNR), gamma, and other video parameters. The visual system design shall ensure compatibility of subsystems regardless of signal magnitude, dynamic range, simulated function nonlinearities, and other factors.

30.2.1.3.5.2 Color registration.

Dynamic registration errors of color primaries shall be less than 0.1 percent of display height within a circle centered on the channel and whose diameter is equal to the greater of 60 percent of the display diagonal or 75 percent of the display width. Color divergence may smoothly increase to a value not exceeding 0.2 percent outside a circle centered on the channel and whose diameter is equal to the greater of 60 percent of the display diagonal or 75 percent of the display width. Following a 45 minute warm-up period (only exception: 15 minutes for direct view CRT monitors), color convergence shall not drift more than +/- 30 percent from its initial value over a continuous 16 hour operation period.

30.2.1.3.6 Image perspective and geometric accuracy.

The CCTT visual systems shall generate and display true perspective images of the three-dimensional visual scene. The scene perspective shall be correct for all simulated eyepoint positions and viewing angles. Visual features which are obscured from view by other objects and the hidden back sides of objects shall not be visible in the display. Spurious images and object outlines shall not result from the occultation, backface elimination or any other image generation process.

Where headtracking is employed to monitor head motion, as the trainee moves his eyepoint throughout the viewing volume the image generator shall recompute the instantaneous image viewpoint for each associated active monitor. The recomputation of the image shall provide the trainee with a perception of parallax to provide enhanced distance cues and an increased sense of depth and the ability to move the instantaneous field of view in a natural manner to allow the trainee to see around nearby objects or to see objects which are in the gaps between vision blocks or otherwise immediately outside of the current viewing area.

30.2.1.3.6.1 Total geometric accuracy.

Total geometric distortion is the error in apparent location for any point in the scene relative to the true projected position expressed as a percentage of specified channel dimension in the narrow direction. The total geometric distortion for each display shall not exceed five percent within a circle whose diameter is 0.6X the display channel diagonal, centered at the channel center as measured from the selected trainee eyepoints. Elsewhere in each display channel, distortion shall not exceed seven percent.

30.2.1.3.6.2 Relative geometric errors.

Within a circle centered on the channel and whose diameter is equal to display’s long dimension, geometric errors in scene points relative to nearby scene points shall not exceed six arc minutes within any two degree cone of vision. Outside the circle the relative geometric error shall not exceed ten arc minutes within any two degree cone of vision.

30.2.1.3.7 Vernier resolution.

Vernier resolution, measured as the minimum discernible apparent displacement of adjacent scene elements and as the minimum detectable relative motion of a scene element relative to the eye, shall be less than 20 percent of the resolution (Optical Line Pair (OLP) spacing) specified for each display.

30.2.1.3.8 Adjacent channel matching.

Gaps in what should be a continuous scene are only allowed in meeting the visual display requirements for the popped hatch mode, CWS (only vertical gaps are allowed), vision blocks (only vertical gaps are allowed), DI, HMMWV and the AAR console. For popped hatch, CWS, and the vision blocks, the gap (discontinuity) in what should be a continuous scene shall be no larger than 2 degrees as measured from the design eyepoint. For the DI and HMMWV, a gap of 5 degrees is allowed. For the AAR console, a gap of 10 degrees is allowed. For displays with adjacent channels, that part of the scene which would fall within the gap in what should be a continuous scene shall be displayed by the surrounding displays.

Where the scene presented is a combination of multiple channels, variations in color, brightness, contrast, resolution, and collimation between adjacent channels shall be minimized for the full range of simulated conditions. Adjacent channels shall be designed so as to minimize the appearance of discontinuity.

30.2.1.3.9 Image stability.

Following a 45 minute (only exception: 15 minutes for direct view CRT monitors) warm-up and normal daily adjustments, the displayed image shall not drift in position more than one pixel per four hours of continuous operation under the specified operating conditions. Peak to peak short term image deviations such as jitter and oscillation shall not exceed 0.04 percent (only exception: 0.02 percent for direct view CRT monitors) of the display diagonal measurement for the specified operating conditions. There shall not be any discernible relative motion between fixed objects in the visual scene except as demanded by the equations of motion for the operator/trainee viewpoint(s). Image drift shall not result in any visual system parameter deviating from the specified values by more than 20 percent at any time during an eight hour operating period.

30.2.1.3.10 Video rate.

The system shall employ either non-interlaced raster at a 60 Hz refresh rate or a maximum of two-to-one interlace with a frame rate of not less than 30 Hz is allowed. A non-interlaced raster is preferred. For scene content management, temporary reductions of these rates of up to 15 percent will be allowed, subject to the following: Reductions of more than 10 percent shall not exceed 15 seconds in duration. The average reduction shall not exceed 3 percent over any 30 minute operating period nor 5 percent over any 5 minute period. Reductions shall not degrade the average transport delay of the complete integrated trainer. Within the above constraints, the controlling algorithms shall be adjusted to optimize time constants, peak reductions and the like to be consistent with other system characteristics such as flicker, subject to approval by the technical representative of the contracting officer. During dusk and night simulation reductions of up to 20 percent may be allowed at the discretion of the Government.

30.2.1.3.11 Update rate.

The position and attitude data for the viewpoint and all moving models shall be updated and a complete scene shall be computed at a rate not less than 15 Hz. For scene content management, temporary reductions will be allowed, subject to the constraints listed under video rates.

30.2.1.3.12 Transport delay.

The time from receiving viewpoint data from the host to completing display of the first field based on that data (transport delay) shall not exceed 217 milliseconds. The transport delay time shall be measured from the time the image generator receives a command to provide a given response to the time the first full resulting field is completed on the display.

30.2.1.3.13 Occulting (hidden surface elimination).

The system shall provide general, all inclusive occulting of objects which are behind other objects without any restrictions on the orientation or real-time motion of objects. Occulting computations shall be performed for not less than four subpixels within each pixel, and reflected in the anti-aliased subpixel intensities. Occulting shall not result in any visible artifacts in the displayed image. All moving models shall be properly occluded by intervening terrain and other visual features without any limitation.

30.2.1.3.14 Smear.

Smear due to image motion shall not degrade resolution in excess of the value specified nor be noticeable in the displayed images.

30.2.1.3.15 Flicker.

Flicker due to image refresh rate shall not be noticeable for the image luminance as specified.

30.2.1.3.16 Stepping.

Stepping or other discrete image motion shall be minimized to the maximum extent practicable for all displays. To minimize stepping in the Commander's Popped Hatch display, the visual system shall provide a pseudo 60Hz update to compensate for horizontal panning of the visual scene. The image generator shall provide the capability to horizontally offset the displayed visual scene at a 60Hz rate to compensate for image motion between 15Hz update cycles.

30.2.1.4 Not used.

30.2.1.5 Image quality (system capacity).

The visual system shall optimize and maximize the density, distribution, and information content of visual features in the scene(s) for all conditions of image generator operation.

30.2.1.5.1 Continuous image density.

The visual system shall continuously maximize the density of displayed visual features, optimize the distribution of scene elements, and optimize the selection of scene elements for display, for the training tasks related to each display, and for the exercise conditions. For all conditions of operation, commensurate with maximizing scene content, maximum instantaneous polygon and object processing capacity specified shall be dedicated to the terrain, features and static models specified herein. Instantaneous polygon and object processing shall be distributed between channels (viewports) (but not between Channel Processors) based on individual channel scene content with individual channel level-of-detail provided. Level-of-detail transition range and the width of transparency band used to fade levels-of detail shall be adjustable to accommodate varying levels of scene content and to minimize operation at reduced update rate. Processing capacity used for special effects and moving models which cause high concentrations of polygons are excluded from the distribution requirement. The term feature denotes representations of separate physical entities (e.g., tree, storage tank, house, field, etc.) with color distinct from the background and sized larger than 3 X 3 pixels.

30.2.1.5.1.1 Feature selection.

The following lists shall be used as the criteria for the selection of features for display in each type of display channel. The relative priority of the features is indicated by the order of the list but that does not imply that all features at the top of the list should be displayed at the expense of having no features from lower items in the list. The selection shall take into account overall tactical significance, maintenance of scene continuity, and the field of view and resolution of the channel. The database working group will determine the final feature selection priority prior to CDR.

a. Gun sights or magnified devices:

  (1) All military equipment, troops, and activities.

(2) Natural and cultural features of inherent military significance (e.g., roads, other lines of communication and transportation, bridges, buildings, natural features which would influence the course of action of military units).

(3) Natural and cultural features which obstruct vision and provide cover and concealment.

b. Driver's vision block and HMMWV and TACP visual displays:

(1) Foreground scene details which influence detail route selection, provide velocity and relative motion and position cues, indicate where and how fast the vehicle should be driven, indicate if an area is passable for the vehicle, indicate surface conditions such as mud, sand, etc.

(2) Items under (a) above at medium ranges based on their size, relevance to route planning and importance to scene continuity.

(3) Medium and far range scene details based on tactical significance and resolution of the display, and to maintain scene continuity.

c. Loader's vision block:

Same as commander's vision block.

d. Commander's vision blocks and popped hatch:

(1) Items from the gun sight list above but with reduced detail consistent with display field of view and resolution.

(2) Items from the driver's list above sufficient for route planning and directing general vehicle motion.

(3) Medium and far range features to assess the general nature of the terrain and features of tactical significance and to support navigation.

e. Dismounted infantry:

(1) All gun sight items.

(2) Items from the driver vision block list with extra emphasis on cover and concealment.

(3) Military items at all ranges sufficient to detect, recognize, identify, and engage targets.

(4) Terrain and vegetation detail at close ranges sufficient to move over terrain and to select and move into cover.

f. After action review console:

(1) Shall default to the same selection criteria as the commander's vision block, however, shall provide the capability to override the default with any one of the above lists.

30.2.1.5.2 Scene content management.

Scene content management shall optimize the training value of the system by ensuring a maximum of needed visual cueing information for current operating conditions, and ensuring a minimum of scene discontinuities and other distracting image processing artifacts which could inhibit user psychological acceptance of the scene. Scene content filtering shall include the effects of visibility, elevation, viewing range, object angular subtense, and object color. Scene content shall be controlled in real-time to accomplish the following:

a. Ensure that the image processing and storage capacity of the system is efficiently utilized, but not exceeded, for all the conditions, and that the requirements for continuous image density are met for all conditions.

b. Ensure optimum selection of features for each display channel according to the functionof that channel.

c. Ensure continuity of the scene and prevent noticeable changes in scene elements.

d. Prevent overload conditions.

e. Minimize operation at reduced update rates.

f. Eliminate scene details when they no longer contribute to the training problem.

g. Ensure that visual features are distributed within the field of view according to crew needs for the applicable tasks.

30.2.1.5.2.1 Scene management mechanisms.

The scene content management mechanisms shall include the following scene control features.

a. Eliminating scene elements from processing when they are hidden from view (behind

b. obstructions).

c. Dynamic removal of scene elements (down to the polygon level) when their projected size precludes their effective use for visual cuing. This may be accomplished in non-real time by assigning transition range values which effectively remove the object when its projected size is too small to contribute to training.

d. Dynamic concentration of scene detail on terrain immediately surrounding own-vehicle and on targets as viewed through a sight.

e. Dynamic modification of scene content control parameters, such as level of detail switching distance.

f. Dynamic control of width of transparency band.

g. Multiple levels-of-detail shall be used in all but the simplest models and sub-models to allow widely varying changes in model complexity.

h. The ability to assign individual channel (viewport) load management.

i. Programmable priority for the above measures and system resources to ensure that the most training critical aspects of scene quality and quantity are the last to be impacted when overload measures are implemented.

30.2.1.5.2.2 Environment integrity.

Scene management shall maintain the integrity of the training environment to ensure that significant features (terrain, culture and moving models) are kept in the scene under all circumstances in which they are essential, e.g., concealment. Environment integrity must be maintained between visual assets within a module/console (intra-module) and modules/consoles networked together in a common exercise (inter-module). Environment integrity shall be maintained to facilitate accurate weapon impact determination. A means to implement effective and realistic concealment simulation shall be provided. Scene features which serve to conceal a unit shall be visible to all observers. The simulation shall include effects for varying degrees of concealment to provide for partially concealed vehicles and dismounted infantry.

30.2.1.5.2.3 Scene management dynamics.

Scene management shall operate at a rate sufficient to ensure that the requirements for image continuity and continuous image density are maintained for all conditions of motion of the vehicle simulated by the host. Scene content management shall occur in a gradual, continuous manner, masked from the viewer to the maximum extent practical. Deletion and insertion of scene elements made by the scene content manager shall be accomplished gradually in a manner which minimizes the objects “popping” into the scene and causing any distraction. This shall include dynamic control of visibility range, transparency, contrast etc., for both individual scene elements and the entire scene, to mask scene content transitions. Changes in the displayed scene made by the scene content manager shall be accomplished at the single object level and several polygon levels, except changes relative to perspective size which shall occur at the single polygon level.

30.2.1.5.2.4 Scene management strategy variations.

Deleted.

30.2.1.5.2.5 Overload prevention.

The system shall detect impending overload conditions prior to the occurrence of any scene discontinuity and shall adjust system parameters to maintain scene continuity. All system resources which can limit scene processing shall be monitored for overload conditions. Adjustments to scene content shall be selected to optimize relief of the exhausted resource. Overload conditions shall not result in the system locking up. The system shall automatically recover to full performance when the overload condition is removed.

30.2.1.6 Display configurations.

The following provides requirements for each general type of display which is common to more than one module/console.

All vision path obstructions/restrictions encountered on the real vehicle (includes limitations resulting from head motion and parts of own-vehicle which obstruct) shall be duplicated in the modules. If a position-attitude sensor is utilized, the sensor and emitter configuration shall not add more than 5 ounces of head supported and/or simulated device weight and shall not interfere with the user’s viewing volume nor restrict movement within the simulated vehicle during the simulation. Methods which are based on a switched/stepped repositioning of the IFOV in response to a position-attitude sensor input shall provide for the following: The displayed image center shall be within 25 degrees of static head pointing direction. The rotation of the displayed image area shall be performed in discrete steps of not more than 45 degrees. With all head rotation less than 60 degrees per second, the displayed image center shall not lag the head pointing direction by more than 36 degrees.

A continuous slew of the IFOV in response to a position-attitude sensor input shall provide for the following: The displayed image center shall be within 30 arc minutes of static head pointing direction. With all head rotation less than 60 degrees per second, the displayed image center shall not lag the head pointing direction by more than 6 degrees. The IFOV shall be slewed in a way which maintains the correct position of the associated imagery while preventing artificialities/anomalies, e.g., perceptible jumps, latencies, and imagery quality degradations. Additionally, the imagery shall remain stable (free from image swim/oscillation and other abnormal movement) with all head rotation less than 60 degrees per second and all head oscillations of less than 1 hz. Where displays are being switched (activated/deactivated) the overall transport delay (from the time the trainee action triggers a display change to completion of resulting field) shall be less than 250 ms.

Limits to traversal (stops), which prevent full flexibility of movement available in the actual vehicle are disallowed, e.g., turret, cupola, sight, and periscope dynamics shall provide the full range of motion available in the actual vehicle. Stops are disallowed where the requirements call for the simulation of a full 360 degrees of horizontal FOV by slewing/switching a smaller FOV, i.e., the simulation shall allow for unlimited rotations clockwise and counterclockwise. With the exception of the NVG simulation, helmet/head mounted display technology is disallowed as an implementation method for the CCTT visual system.

The requirement for total FOV can be simulated by providing an active display area with a FOV which is larger, relative to the design eyepoint, than the instantaneous FOV (accomplished by the use of an aperture/obstruction which restricts the optical path). As an alternate approach, the total FOV can be simulated independent of head motion by having the IG recompute the imagery in a fixed instantaneous FOV in response to operator input. The specified total FOV, both vertical and horizontal, shall be provided by a means whereby operator activation is not required. The use of manual switch/control activations, which are not required in the actual vehicle, to control visual system functions (e.g. selection of look direction) is disallowed except in the following cases:

a. Binocular and Night Vision Devices

b. To select appropriate imagery for the simulation of Total FOV.

c. This is only allowed where a total FOV requirement is explicitly stated.

d. Deleted

The methods used to satisfy the display configuration requirements shall be carefully selected so as to minimize the negative impact of scene and training artificialities (e.g. latencies, perceptible display switching, and control/switch activations not required in the actual vehicle) on the trainees.

30.2.1.6.1 Full circle vision block configurations.

For crew stations which provide a full 360 degrees of horizontal FOV via a set of vision blocks mounted in a circle around the crew members head position (e.g. tank commanders), a complete set of simulated vision blocks shall be located around the head position just as in the design basis vehicle, however, for any given time only three, adjacent vision blocks need be active. The crew member shall have the ability to select the active vision blocks. The selection method shall provide the operator with the same freedom of movement available in the actual vehicle and shall not require control/switch activations not required in the actual vehicle. When the vision blocks are integrated with the Popped Hatch Display such that the image seen through the vision block is the image on the Popped Hatch display, then the FOV and resolution requirements of the vision blocks shall be the same as that as the Popped Hatch with the FOV truncated by the mechanical limitations of the vision blocks.

30.2.1.6.2 Popped hatch displays.

For crew stations with a popped hatch capability a large total FOV, 360 degrees horizontal by 38 degrees vertical, shall be accessible but only a portion (instantaneous FOV) of it shall be available at any given time. The popped hatch view shall be provided via a set of displays fully or partially surrounding the crew member's head position.

The popped hatch shall be as follows:

a. For the popped hatch, a minimum instantaneous FOV of 180 degrees by 27.39 degrees shall be active (unless binoculars or NVG are in use) as long as the hatch is in the popped position.

b. For the popped hatch, the full 360 degree horizontal FOV shall be provided in response to the crew member's horizontal head rotation. A means of having the physical location of the center of the instantaneous FOV follow the operator's horizontal look direction shall be provided. The means used to steer the FOV horizontally shall provide the operator with the same freedom of movement encountered in the actual vehicle and shall not require control/switch activations not required in the actual vehicle. A means shall also be provided to view the remaining 10.5 degrees of vertical FOV. However, the physical location of the center of the instantaneous FOV need not be repositioned vertically. Changing the scene to represent a pitch up/down is acceptable.

c. In the popped hatch, a binocular simulation shall be provided. It is acceptable to provide this simulation by replacing the active 180 degree FOV with a smaller FOV which is consistent with 7 x 50 field binoculars and providing a means for the operator to steer it. This means shall be such that negative training is minimized. It is unacceptable to base the simulation on the use of actual binoculars.

d. In the popped hatch, a NVG capability shall be provided. It is acceptable to provide this simulation by replacing the active 180 degree FOV with a smaller FOV which is consistent with 40x30 NVG and providing a means for the operator to steer it.

e. In the popped hatch, if this same display resource is used to satisfy other display requirements herein, a means of compensating for the difference in eyepoints shall be provided.

f. Deleted

30.2.1.6.3 Driver displays.

Driver displays shall be as follows:

a. For the driver, all display vision blocks shall be active at all times.

b. Deleted

30.2.1.6.4 Loader displays.

Loader (hatch-mounted) displays shall be as follows:

a. The loader's vision block shall always be active.

b. For the loader, a full 360 degree horizontal FOV shall be provided by manual rotation of the vision block.

c. Deleted

30.2.1.6.5 Sights (primary, backup, and extension, (optical and thermal)).

The sights and periscopes with magnification shall be as follows:

a. For the magnified periscopes and sights, just as in the actual vehicle, the sight extension shall duplicate the image seen by the gunner in the primary sight.

b. The magnified periscopes and sights shall have the capability to change magnification, reticles, pointing direction, image source (optical, thermal, or image intensifier) as in the actual vehicle. For the magnified periscopes and sights, all rangefinding devices, laser designators and laser rangefinders shall function as in the actual vehicle. For the magnified periscopes and sights, switching times and control response shall be comparable to the actual vehicle. For the magnified periscopes and sights, moving reticles shall be fully simulated.

c. For all magnified periscopes and sights, it is acceptable to simulate the FOV as a circle with a truncated top and bottom (this results from fitting the circular FOV to a standard display with a 4/3 aspect ratio). The FOV as viewed through the eyepiece shall be the specified computed FOV, the physical FOV shall be that provided by the eyepiece.

d. The magnified periscopes and sights shall display all reticles for all modes of operation with the correct color, content, size and resolution.

e. Deleted

30.2.1.7 Module/Console specific FOV and resolution requirements.

The following requirements apply to specific vehicle and force modules. Other characteristics which could be covered in parametric fashion as general requirements are provided elsewhere in this specification. The specific module FOV requirements below are provided for proposal purposes.

With the exception of popped hatch, the module displays shall provide the same FOV (including up/down orientation of the vertical FOV), real and apparent, total and instantaneous, as in the actual vehicle, based on data and measurements obtained by the contractor, unless otherwise directed by the procuring agency. Proportional changes in specified resolution would accompany all FOV changes. Except in those cases where a proportional change is needed, the resolution values specified are the maximum values acceptable. The location, size and orientation of all the vision blocks, periscopes (with magnification), sights and sensors shall be the same as in the actual vehicle.

Target detection and recognition shall be measured in meters. The terms detection and recognition are equivalent to their definitions in Johnson's criteria and are repeated below. The specific ranges listed below are based on the standard target, 2.5 meters high.

Detection - An object is present. Requires 1.5 active scanning TV lines across the object.

Recognition - The class to which an object or target belongs may be discerned, e.g., a small vehicle (like a jeep), a mid-sized vehicle (like an M1) and a transport aircraft. Requires 7.5 active scanning TV lines across the object.

FOV (instantaneous and total) is specified as degrees horizontal x degrees vertical. The FOV requirements throughout this section refer to the computed FOV. Unless otherwise specified, the physical (measurable at the eyepoint) FOV shall be equal to the computed FOV within +/- 10%. Where mechanical restrictions for the viewing devices or other obstructions of the optical path prevent full compliance with this requirement, the deviation shall be minimized to the maximum extent possible and must be approved by the procuring agency. Circular sights specified as having unequal horizontal and vertical fields of view shall be understood to represent a circle with a truncated top and bottom (This results from fitting the circular FOV to a standard display with a 4/3 aspect ratio). For magnified sights, the FOV is stated in terms of the true FOV as opposed to the apparent FOV. Resolution shall be measured in arc-minutes per optical line pair. Resolution is the average vertical resolution specified in arc-minutes per optical line pair. The specified resolution value applies to all aspects of the scene, not just the targets. The worst case vertical resolution shall be no greater than 110% of the specified average vertical resolution. Range is specified in meters and is rounded to nearest hundred. For systems which magnify, the resolution is stated in terms of the acceptance/true FOV as opposed to the apparent FOV. For all static head pointing directions (azimuth only), that part of the FOV which is within plus or minus 15 horizontal degrees of the head pointing direction shall meet the respective popped hatch and DI resolution requirements specified in subsequent parts of this section. The FOV falling outside of the viewing area defined above shall have resolution no worse than 2 times the respective resolution requirements for popped hatch and DI. Where the given system must support two operators, each shall have a dedicated, independent higher resolution viewing area. In all cases, the higher resolution area shall follow the head look direction without the need for operator intervention through controls/switches.

30.2.1.7.1 M1A1/M1A2 tank module.

The following requirements apply to the M1A1 AND M1A2 modules except where a subparagraph is specifically labelled as applicable only to a particular version(s) of the M1:

a. In the M1A1 the Tank Commander shall have: Six vision blocks and the Commanders Weapon System Sight (CWS) in a slewable cupola just like the actual vehicle and, when applicable, a popped hatch capability with three modes of operation (normal, binocular and NVG).

Commander's cupola (M1A1 only):

(1) Instantaneous FOV (short vision blocks), 1X	34.9x9.0
Instantaneous FOV (long vision block), 1X	25.6x6.5
Instantaneous FOV (CWS), 3X	6.7 +/- 0.5
(2) Total FOV (each vision block), 1X	60 X 18
(3) Resolution (vision blocks), 1X	6.1
Resolution (CWS), 3X	3.5

(4) Detection range (vision blocks), 1X	2400
Detection range (CWS), 3X	4000
(5) Recognition range (vision blocks), 1X	500
Recognition range (CWS), 3X	900

b. In the M1A2 the Tank Commander shall have: Eight vision blocks in a cupola just like the actual vehicle and, when applicable, a popped hatch capability with three modes of operation (normal, binocular and NVG).

Commander's cupola (M1A2 only):

(1) Instantaneous FOV (each vision block), 1X	34.9x9.0
Total FOV (each vision block), 1X	45 X 18
(2) Resolution (vision blocks), 1X	6.1
(3) Detection range (vision blocks), 1X	2400
(4) Recognition range (vision block), 1X	500

c. In the M1A1 and M1A2 module the commander's popped hatch shall be supported, when applicable.

Popped hatch (M1A1/M1A2):

(1) Instantaneous FOV, 1X	180x27.4
Instantaneous FOV, 7X (binoculars)	5.3x4.0
Instantaneous FOV, (NVG)	36.0x27.4
(2) Resolution, 1X	6.1
Resolution, 7X	1.0
Resolution, (NVG)	6.1
(3) Detection range, 1X	2400
Detection range, 7X	4000
Detection range, (NVG)	2400
(4) Recognition range, 1X	500
Recognition range, 7X	2400
Recognition range, (NVG)	500

d. For the M1A2 Tank Commander the Commander's Independent Thermal Viewer (CITV) shall be provided.

CITV (M1A2 only):

(1) CITV Instantaneous FOV, 3X	10X7.5
CITV Instantaneous FOV, 10X	3.00x2.2
(2) Resolution, 3X	1.5
Resolution, 10X	0.5
(3) Detection range, 3X	4000
Detection range, 10X	4000

(4) Recognition range, 3X — 2000
Recognition range, 10X — 4000

e. In the M1A1 and M1A2 modules, three vision blocks and one installable AN/VVS-2 night viewer shall be provided for the driver.

Driver (M1A1/M1A2):

(1) Day (optical) mode:

(a) Instantaneous FOV (center vision block), 1X,	34.9x9.0
(b) Instantaneous FOV (left/right vision blocks), 1X	22.3x9.00
(c) Total FOV (center vision block), 1X	60 X 18
(d) Total FOV (left/right vision blocks), 1X	38.2x18.0
(e) Resolution (vision blocks), 1X	6.1
(f) Detection range (vision blocks), 1X	2400
(g) Recognition range (vision blocks), 1X	500

(2) Night mode (Image intensification):

(a) Instantaneous FOV, 1X	35.2x18.0
Total FOV, 1X	125X 18
(Total FOV includes mechanical selection of viewing angle)	
(b) Resolution, 1X	6.1
(c) Detection, 1X	2400
(d) Recognition, 1X	500

f. In the M1A1 and M1A2 modules, one vision block shall be provided for the Loader.

Loader (M1A1/M1A2):

(1) Instantaneous FOV,1X	34.9x9.0
(2) Total FOV, 1X	360x18
(Total FOV includes mechanical rotation of vision block)	
(3) Resolution, 1X	6.1
(4) Detection range, 1X	2400
(5) Recognition range, 1X	500

g. In the M1A1 and M1A2 modules, one circular sight shall be provided for the gunner's primary sight (GPS) and commander's GPS extension (GPSE).

Gunner and commander (M1A1/M1A2):

(1) Optical mode:

(a) Instantaneous FOV, 1X (unity window)	18.0x6.0
Instantaneous FOV, 3X	18.9x14.2

	Instantaneous FOV, 10X	5.7x4.3
(b)	Resolution, 1X	6.1
	Resolution, 3X	2.8
	Resolution, 10X	0.9
(c)	Detection range, 1X	2400
	Detection range, 3X	4000
	Detection range, 10X	4000
(d)	Recognition range, 1X	500
	Recognition range, 3X	1100
	Recognition range, 10X	3100

(2) Thermal mode:

(a)	Instantaneous FOV, 3X	15.4x8.3
	Instantaneous FOV, 10X	4.6x2.5
(b)	Resolution, 3X	2.8
	Resolution, 10X	0.8
(c)	Detection range, 3X	4000
	Detection range, 10X	4000
(d)	Recognition range, 3X	1100
	Recognition range, 10X	3100

h. In the M1A1 and M1A2 modules, one circular sight shall be provided for the gunner's auxiliary sight (GAS).

Gunner (M1A1/M1A2):

(1)	Instantaneous FOV, 8X	7.1x5.4
(2)	Resolution, 8X	1.2
(3)	Detection range, 8X	4000
(4)	Recognition range, 8X	2400

30.2.1.7.2 M2A2 Infantry fighting vehicle and M3A2 cavalry fighting vehicle module. The following requirements apply to the M2A2/M3A2 Bradley fighting vehicle.

a. In the M2A2 and M3A2 module, the Tank commander shall be provided with seven vision blocks and, when appropriate, a popped hatch capability with three modes of operation (normal, binocular and NVG).

Commander’s hatch (M2A2/M3A2):

(1)	Instantaneous FOV (each vision block), 1X	24.7x6.3
(2)	Total FOV (each vision block), 1X	48 X 12
(3)	Resolution (vision blocks), 1X	6.1
(4)	Detection range (vision blocks), 1X	2400
(5)	Recognition range (vision blocks), 1X	500

b. In the M2A2 and M3A2 module, the commander’s popped hatch shall be supported, when applicable.

Popped hatch (M2A2/M3A2):

(1)	Instantaneous FOV, 1X	180x27.4
	Instantaneous FOV, 7X (binoculars)	5.3x4.0
	Instantaneous FOV, (NVG) 4	36.0x27.4
(2)	Resolution, 1X	6.1
	Resolution, 7X	1.0
	Resolution, (NVG)	6.1
(3)	Detection range, 1X	2400
	Detection range, 7X	4000
	Detection range, (NVG)	2400
(4)	Recognition range, 1X	500
	Recognition range, 7X	2400
	Recognition range, (NVG)	500

c. For the M2A2 and M3A2 modules, the driver shall be provided with four M17 vision blocks and one AN/VVS-2 night viewer.

Driver (M2A2/M3A2):

(1) Day (optical) mode:

(a)	Instantaneous FOV(each vision block), 1X	31.2x8.0
(b)	Total FOV (each vision block), 1X	43 X 12
(c)	Resolution (vision blocks), 1X	6.1
(d)	Detection range (vision blocks), 1X	2400
(e)	Recognition range (vision blocks), 1X	500

(2) Night mode (Image intensification):

(a)	Instantaneous FOV, 1X	35.2x18.0
	Total FOV, 1X	125X 18

(Total FOV includes mechanical selection of viewing angle)

(b)	Resolution, 1X	6.1
(c)	Detection range, 1X	2400
(d)	Recognition range, 1X	500

d. For the M2A2 and M3A2 modules, the gunners integrated sight unit including the commanders relay assembly shall be provided.

Gunner and Commander (M2A2/M3A2):

(1) Optical mode:

(a)	Instantaneous FOV, 1X (Unity window)	11.0x5.5
	Instantaneous FOV, 4X	14.2x10.7
	Instantaneous FOV, 12X	4.8x3.6
(b)	Resolution, 1X	6.1
	Resolution, 4X	2.3
	Resolution, 12X	0.8
(c)	Detection range, 1X	2400
	Detection range, 4X	4000
	Detection range, 12X	4000
(d)	Recognition range, 1X	500
	Recognition range, 4X	1300
	Recognition range, 12X	4000

(2) Thermal mode:

(a)	Instantaneous FOV, 4X	7.1x5.4
	Instantaneous FOV, 12X	2.4x1.8
(b)	Resolution, 4X	2.3
	Resolution, 12X	0.8
(c)	Detection range, 4X	4000
	Detection range, 12X	4000
(d)	Recognition range, 4X	1300
	Recognition range, 12X	4000

e For the M2A2 and M3A2 modules, the gunner’s hatch shall have two visionblocks.

Gunner (M2A2/M3A2):

(1)	Instantaneous FOV (each vision block), 1X	11.0x5.5
(2)	Total FOV (each vision block), 1X	11.0x5.5
(3)	Resolution (vision blocks), 1X	6.1

(4) Detection range (vision blocks), 1X 2400

(5) Recognition range (vision blocks), 1X 500

f. For the M2A2 and M3A2 modules, the gunner shall be provided with one circular sight. Backup sight: One circular sight.

Gunner BUS (M2A2/M3A2):

(1) Instantaneous FOV, 5X	11.4x8.6
(2) Resolution, 5X	1.7
(3) Detection range, 5X	4000
(4) Recognition range, 5X	2000

30.2.1.7.3 M981 fire support team vehicle module (FIST-V).

The following requirements apply to the M981 FIST-V module.

a. In the M981 FIST-V module, the Commander's hatch/targeting station shall have Seven M17 vision blocks in a slewable hatch just like the actual vehicle.

Commander (M981 FIST-V):

(1) Instantaneous FOV (each vision block), 1X	31.2x8.0
(2) Total FOV (each vision block), 1X	31.2x8.0
(3) Resolution (vision block), 1X	6.1
(4) Detection range (vision blocks), 1X	2400
(5) Recognition range (vision blocks),	500

b. For the M981 FIST-V driver, Four M17 vision blocks and one M19 night vision device shall be provided.

Driver (M981 FIST-V):

(1) Day (optical) mode:

(a) Instantaneous FOV (each vision block), 1X	31.2x8.0
(b) Total FOV (each vision block), 1X	34 degrees X 12 degrees
(c) Resolution (vision blocks), 1X	6.1
(d) Detection range (vision blocks) , 1X	2400
(e) Recognition range (vision blocks) , 1X	500

(2) Night mode:

Instantaneous FOV, 1X	31.2x8.0
(a) Resolution, 1X	6.1
(b) Detection range, 1X	2400
(c) Recognition range, 1X	500

c. For the M981 FIST-V gunner’s sights, the simulated gunner’s sights shall have the capability of selecting an optical acquisition sight, a thermal nightsight, and a ground vehicle laser locator designator/range finder. The circular sight, in optical and thermal modes of operation, shall have two different magnification levels.

Gunner (M981 FIST-V):

(1) Optical mode:

(a)	Instantaneous FOV, 3X	22.6x17.1
(b)	Instantaneous FOV, 13X	5.3x4.0
(c)	Resolution, 3X	3.7
(d)	Resolution, 13X	0.8
(e)	Detection range, 3X	4000
(f)	Detection range, 13X	4000
(g)	Recognition range, 3X	800
(h)	Recognition range, 13	4000

(2) Thermal mode:

(a)	Instantaneous FOV, 3X	6.8X 5.1
	Instantaneous FOV, 13X	6.0x3.8
(b)	Resolution, 3X	3.7
	Resolution, 13X	0.8
(c)	Detection range, 3X	4000
	Detection range, 13X	4000
(d)	Recognition range, 3X	800
	Recognition range, 13X	4000

d. In the M981 FIST-V module, the Observation station panoramic telescope shall be provided. The simulated observation station panoramic telescope shall rotate throughout 360 degrees, providing the observation station full horizontal field of view coverage.

Observer (M981 FIST-V):

(1)	Instantaneous FOV, 4X	17.1x12.8
(2)	Resolution, 4X	2.1
(3)	Detection range, 4X	4000
(4)	Recognition range, 4X	1600

30.2.1.7.4 Not Used.

30.2.1.7.5 M113A3 armored personnel carrier (APC).

The following requirements apply to the M113A3 full tracked armored personnel carrier module:

a. For the M113A3 APC, the driver shall have four M17 vision blocks and one M19 night vision device.

Driver (M113A3 APC):

(1) Day (optical) mode:

(a) Instantaneous FOV (each vision block), 1X	31.2x8.0
(b) Total FOV (each vision block), 1X	34 degrees X 12 degrees
(c) Resolution (vision blocks), 1X	6.1
(d) Detection range (vision blocks), 1X	2400
(e) Recognition range (vision blocks),1X	500

(2) Night mode:

(a) Instantaneous FOV, 1X 2	31.2x8.0
(b) Resolution, 1X	6.1
(c) Detection range, 1X	2400
(d) Recognition range, 1X	500

b. For the M113A3 APC, the commander’s cupola shall be comprised of five vision blocks in a slewable hatch just like the actual vehicle.

Commander (M113A3 APC):

(1) Instantaneous FOV (each vision block),1X	31.2x8.0
(2) Total FOV (each vision block), 1X	31.2x8.0
(3) Resolution (vision blocks), 1X	6.1
(4) Detection range (vision blocks), 1X	2400
(5) Recognition range (vision blocks), 1X	500

c. For the M113A3 APC commander’s hatch, no visual displays are required.

30.2.1.7.6 High mobility multipurpose wheeled vehicle (HMMWV) module. Each HMMWV module shall have a visual display system which serves both the driver and observer. The HMMWV module shall have three user selectable modes: unaided eye, binocular, and image intensifier. The driver and forward observer display systems for the HMMWV shall have multiple direct view displays (minimum monitor size of 19 inches) which together present an instantaneous FOV of 108 by 27.4 degrees.

For the HMMWV module, a display system serving both the driver and forward observer shall be provided.

(1) Instantaneous FOV, 1X	108X 27.4
Instantaneous FOV, 7X (binoculars)	5.3x4.0
Instantaneous FOV, (NVG)	36x27.4

(2)	Resolution, 1X	6.1
	Resolution, 7X	0.9
	Resolution, (NVG)	6.1
(3)	Detection range, 1X	2400
	Detection range, 7X	4000
	Detection range, (NVG)	2400
(4)	Recognition range, 1X	500
	Recognition range, 7X	2400
	Recognition range, (NVG)	500

30.2.1.7.7 Dismounted infantry (DI) module.

Each DI module shall have three visual display systems. In the DI module, two of the systems shall each serve a single operator, squad leader, and the third shall be shared by the forward observer (FO) and a platoon leader (PL), i.e., the same visual scene shall serve both the FO and PL. The DI module shall have three user selectable modes: unaided eye, binocular, and image intensifier. For the DI display system there shall be multiple direct view displays (minimum monitor size of 19 inches) which together present an instantaneous FOV of 180 by 27.4 degrees.

(1)	Instantaneous FOV, 1X	180 X 27.4
	Instantaneous FOV, 7X (binoculars)	5.3 x 4.0
	Instantaneous FOV, (NVG)	36 x 27.4
	Dragon FOV (Day)	6.0
	Dragon FOV (IR)	3.4 x 6.8
	Javelin FOV (Day)	5.4 x 6.8
	Javelin FOV (IR)	4.58 x 6.11
(2)	Javelin FOV (IR)	2.0 x 3.0
	Resolution, 1X	6.1
	Resolution, 7X	0.9
	Resolution, (NVG)	6.1
	Resolution, Dragon Day, 6x	1.3
	Resolution, Dragon IR,	4x 0.8
	Resolution, Javelin Day, 4x	1.2
	Resolution, Javelin IR, 4.2x	1.0
	Resolution, Javelin IR, 9x	0.4
(3)	Detection range, 1X	2400
	Detection range, 7X	4000
	Detection range, (NVG)	4000
	Detection range, Dragon Day 6x	4000
	Detection range, Dragon IR 4x	4000
	Detection range, Javelin Day 4x	4000
	Detection range, Javelin IR 4.2x	4000
	Detection range, Javelin IR 9x	4000
(4)	Recognition range, 1X	500

Recognition range, 7X	2400
Recognition range, (NVG)	500
Recognition range, Dragon Day	2400
Recognition range, Dragon IR	2400
Recognition range, Javelin Day	2400
Recognition range, Javelin IR	2400

30.2.1.7.8 After action review console - visual display.

For the AAR console, there shall be a minimum of three direct view displays (minimum monitor size of 19 inches) which together provide an instantaneous FOV of 120 by 30.5 degrees. The AAR visual display system shall have three modes of operation: independent, tethered and slaved as described in paragraph 3.7.2.2.3. The AAR visual display shall be available during real-time and playback modes. For the AAR console, the displayed scene shall be operator selectable as unaided, thermal, and light intensifier. The displayed image shall repeat the associated characteristics of the selected displayed image including magnification, reticle and displayed data. The AAR visual display shall provide the capability to display magnified images equivalent to the selected crew member position when operating in the slaved mode and shall be capable of providing 3X and 10X magnification when operating in the tethered mode.

For the AAR console, a 3 channel display system with the following characteristics shall be provided:

(1)	Instantaneous FOV perchannel (normal)	40X30.5
	Instantaneous FOV, (thermal)	40X30.5
	Instantaneous FOV (NVG)	40X30.5
(2)	Resolution, 1X (normal)	6.8
	Resolution, (thermal)	6.8
	Resolution, (NVG)	6.8
(3)	Detection range, 1X (normal)	2400
	Detection range, (thermal)	2400
	Detection range, (NVG)	2400
(4)	Recognition range, 1X (normal)	500
	Recognition range, (thermal)	500
	Recognition range, (NVG)	500

30.2.1.7.9 After Action Review - debrief display.

The AAR debrief display shall be a 68 inch by 92 inch front or rear color projection display system with a screen gain of 1. The AAR debrief display system shall provide a single channel large screen display with the raster format (number of lines and pixels) being the same as the AAR plan view display. The display shall be able to display any channel of the AAR visual display as described in paragraph 30.2.1.7.8 or the AAR plan view display as described in paragraph 3.7.2.2.1.1. The AAR debrief display deflection circuitry shall be synchronized/genlocked with the source AAR console to eliminate screen roll during source select.

30.2.1.7.10 Tactical Air Control Party console - visual display.

For the TACP console, there shall be a minimum of one direct view display (minimum monitor size of 19 inches) with a computed FOV of 40 by 30.5 degrees.

For the TACP console, a 1 channel display system with the following characteristics shall be provided:

(1)	Instantaneous FOV per channel (normal)	40X30.5
	Instantaneous FOV, 7X (binoculars)	5.8x4.4
	Instantaneous FOV (NVG)	40 X 30.5
(2)	Resolution, 1X	6.8
	Resolution, 7X	0.9
	Resolution, (NVG)	6.8
(3)	Detection range, 1X	2400
	Detection range, 7X	4000
	Detection range, (NVG)	2400
(4)	Recognition range, 1X	500
	Recognition range, 7X	2400
	Recognition range, (NVG)	500

30.2.1.8 Electro-optics sensor image simulation.

The CCTT shall have sensor simulation capability. The sensor simulation capability shall include thermal imaging and low light amplification in the form of Night Vision Goggles (NVG) and appropriate installable/switchable devices (those available in the actual vehicles). Sensor simulation modes shall be available at all times, where appropriate, during a simulation session. The selection time to and from sensor modes shall not exceed selection times in the actual vehicle.

The initial conditions shall be controllable from the MCC during exercise generation. The viewed sensor image magnifications (where magnification is selectable on installed equipment), fields of view, and viewing pupils shall at all times be the same as in the operational equipment, except where deviation is allowed. Simulation of corresponding sensor viewer overlay information, e.g., range, bearing, crosshairs, etc., is required.

30.2.1.8.1 Sensor image database.

The electro-optic sensors simulation shall utilize the visual database with additional descriptors and object data necessary to generate images with the fundamental characteristics of the sensor being simulated. Use of the visual database for sensor image generation shall not result in degradation of the capabilities of either the standard visual or sensor image generation. The imagery shall be designed to simulate the unique characteristics of night vision intensifiers and thermal sensing equipment. This would include but is not exclusive to noise and blooming. A simplified model of blooming may be used. Only the blooming effects of flares, muzzle flash, bright artificial lights, and fire need be simulated. For sensor simulation, illumination, contrast, and database content shall be designed to optimize the fidelity of the scene during viewing with a simulated sensor as opposed to viewing with the unaided eye and other sensor sights.

30.2.1.8.2 EO simulation optics.

All optics shall be designed in accordance with 30.7.2.2.

30.2.1.8.3 Thermal sight image simulation.

The thermal images shall be generated about the instantaneous optical line-of-sight of the thermal receiver optics. Under MCC operator control, four environmental thermal conditions: wet hot day, dry hot day, wet cold day, and dry cold day for the database shall be selectable.

The thermal conditions shall be simplified representations of the thermal imagery which provides a generally correct appearance for all objects for a given time of day, temperature and atmospheric condition. Thermal signature simulation may be absolute in thermal representation and simplified by creating generic thermal signatures by type of model e.g., tank, armored personnel carrier, wheeled armored, truck, etc. Simulation of thermal signatures emitted through tactical smoke, fog, and vegetation is required. A method shall be employed to ensure that displayed thermal intensity is a function of material type. The effect of atmospheric attenuation shall be computed in real time using a fading function appropriate to infrared. The simulated thermal image shall simulate thermal noise to the thermal imagery video to produce a realistic appearance. The thermal image simulation shall exhibit the response to operator manipulation of sensitivity, gain, contrast and other controls applicable to each vehicle to approximate the relationship between control settings, environmental conditions, and the displayed imagery. Both white-hot and black-hot modes shall be simulated.

30.2.1.8.4 Night vision image intensifier.

The CCTT shall provide a realistic simulation of the use of low light level vision intensification equipment via NVG and installed equipment in each vehicle. The installed intensification simulation shall be done with a simulated instrument having the look and feel of operational equipment and existing module/console display assets. When simulating instruments of the operational intensification equipment, operational mechanical adjustment features and electrical controls shall be simulated. NVG shall have an on/off switch. NVV shall have controls as referenced in Appendix J-30.1.2.1. When existing display assets are used, all electrical controls and fields of view restrictions shall be simulated. As part of simulation initial condition setup performed at the MCC, the intensifier simulation shall provide selectable natural illumination. The options shall include an overcast condition and three phases of lunar illumination (0 (starlight only), ½, and full moon). The lunar phase and illumination levels shall correspond to real world conditions.

30.2.1.8.5 Laser range finder.

The system shall simulate the laser range finder for units which have that capability. Range finder information shall be provided in the same manner as in the operational equipment for targets that are within the line of sight of the reticle center. The range finder simulation shall provide range information for targets or terrain from 200 meters to the maximum visible range with an accuracy of +/- 3 meters. When the laser range finder mode is activated, proper fire control symbology shall be generated in the appropriate sights. The range finder shall also simulate false/doubled echoes and natural obscurants (i.e. haze, fog, etc.) The effectiveness of the range finder shall be affected by the use of tactical smoke.

30.3 Design requirements.

30.3.1 General design requirements.

The general design requirements of the CCTT system specification shall apply to the image generation and display system. The following additional requirements shall apply:

30.3.2 Design to minimize risk.

The subsystems and components for the CCTT image generation and display system shall be selected to minimize performance, cost and schedule risk. To the maximum extent possible, NDI subsystems and components shall be used, with NDI category A being strongly preferred. Commercial equipment shall be selected from suppliers with relevant experience who have established product lines and support systems.

Commercial components shall be established, proven products or derived from such products. The image generator is exempt from the Trainer Unique Equipment (TUE) requirements. However, the image generator shall be either NDI or an extension of an existing NDI product line.

30.3.3 Design constraints.

Some requirements of this specification are stated in terms of contemporary practices in commercial real-time computer image generation. Where such requirements refer to specific implementation methods, other methods which yield equal value in all respects may be submitted for government consideration. The government reserves the right to determine the acceptability of the approach, i.e., whether the method yields equal value in all respects.

Some performance herein is specified on a "per channel" basis. For these requirements a minimum number of channels is assumed for each CCTT vision asset as shown below:

Some performance herein is specified on a "per channel" basis. For these requirements the team channel shall be as defined herein. A minimum number of channels is assumed for each CCTT vision asset as shown below:

Minimum Number

Vision Asset	of channels
Each vision block	1
Each weapon sight	1
Each thermal imagery system	1
Each light intensification device	1
Each console visual display monitor	1
Each Popped hatch/Dismounted Infantry display system (180 degree horizontal FOV)	5
Each HMMWV display system (108 degree horizontal FOV)	3
Binoculars	1

However, the performance established by the assumed number of channels combined with any “per channel” requirements here-in shall establish the performance requirements for each vision asset.

The actual visual system design need not 1) be highly channelized as implied by the specification or 2) comply with the number of channels assumed above. However, the performance established by the assumed number of channels combined with any “per channel” requirements herein shall establish the performance requirement for each vision asset.

30.3.4 Visual environment design.

The following priorities shall apply to the visual environment design: (1) provide the visual cues needed to accomplish the specified training tasks using the same cues which are used in the corresponding real world situation whenever possible; and (2), optimize scene fidelity to provide the correct visual sensation for each task and the illusion of the real-world operations. The design goal shall be to simulate the information content and appearance of real-world objects, not necessarily the objects themselves. Whenever necessary to provide training in the specified tasks and subject to PCO approval, visual augmentation and scene enhancements shall be incorporated to compensate for inadequacies in available visual simulation systems. The environment models shall efficiently utilize all the resources of the system such as polygon and object processing capacity, hardware texture capabilities, scene content management features, special environment modeling features, etc. The modeling methods shall ensure that optimum scene detail and visual information content are maintained for all conditions of operations. All the database needs/products (versions for day, dawn, dusk, night, thermal and NVG; versions for different IG’s; version for SAF; version for the plan view system terrain and feature database; and those versions required for the map development process) associated with a given deliverable database shall be compiled from a single, common terrain and feature source database for the visual environment, i.e., separate database development efforts for the different products are not allowed. This shall be designed and built to ensure that the various products are all in complete agreement relative to the location and characteristics of said terrain and features. The compilation process shall be automated to the maximum extent practicable.

30.3.4.1 Environment design principles.

The design of the visual scene shall be based on an analysis of the training tasks specified using established principles of a systems approach to training and the results of recognized research in visual cuing. The analysis shall identify the visual information needed by the trainee, the real-world sources of the information, and the simulated visual scene elements which shall be used to provide the information. The size, contrast, location, and other relevant characteristics of important visual cue elements shall be designed to ensure adequate cue fidelity for all conditions encountered in the training task. The environment databases shall be developed from maps, drawings, photographs, on-site observations of actual environment features and from data relative to the training tasks and the gaming areas specified. Environment design shall be coordinated with the Government during the database working group sessions as required by the contract. Additional data sources which are identified during the database working group sessions shall also be used in the design of the environment. Drawings, sketches, narrative descriptions, cuing requirements analyses, and sample model demonstrations shall be used to facilitate the design review process and to verify the effectiveness of visual cuing.

30.3.4.1.1 Environment models development.

The environment models shall be developed to provide the visual cues required to accomplish the specified training tasks. The visual models shall be developed to provide maximum realism within the limitations of scene computational and display capability.

Modeling shall be optimized to provide useful scene content rather than highly realistic images of real world content. Environment models, shall be modeled such that the entire computational and display capability of the visual system is effectively utilized for the scene at the altitude and ranges encountered in the accomplishment of the task. Scene content should be distributed throughout the gaming area to provide realistic scenes and realistic transition between different environment types.

Primary emphasis shall be on placement of scene detail for visual and sensor information for realistic task performance.

30.3.4.1.1.1 Compensation for system limitations.

The design of the CCTT visual system shall compensate for inherent system performance limitations which would preclude depicting the real-world visual scene accurately by insuring that optimum cues are provided. The compensation may deviate from real-world conditions and at times may be somewhat synthetic if necessitated by specific cuing requirements. The form of compensation in the CCTT visual system shall minimize the departure from real-world appearance and preserve the illusion of realism. Several categories of compensatory cues are specified in the subparagraphs below in order of preference; however, relative cuing value may alter the order of preference in some situations. All departures from real-world scene content and appearance shall require prior specific approval by the PCO. The contractor shall assess, recommend, and subject to PCO approval implement the compensation techniques listed below. The assessment shall weigh the benefit provided by the enhanced cue against the negative training aspect(s) associated with the introduction of artificialities. Subtle but effective enhancements are considered to be the most favorable form of enhancement.

30.3.4.1.1.1.1 Enhanced cues.

When the visual information provided by simulated real-world scene elements is inadequate or erroneous, enhancement of the real-world scene elements shall be assessed. Increased size and contrast, exaggerated colors, increased frequency of occurrence, and other similar enhancements shall be considered. The assessment shall include evaluation of enhancements which compensate for limited resolution by maintaining size constancy (object is dynamically scaled to maintain constant subtended angle over significant range).

30.3.4.1.1.1.2 Substitute cues.

Whenever the visual system representation of the actual visual environment cannot provide the needed cues, a substitute representation shall be considered so as to provide a stronger visual sensation of the needed information.

30.3.4.1.1.1.3 Abstract cues.

Abstract scene elements which do not resemble or represent real-world features but which are designed to provide the strongest possible visual sensation of the needed information shall be considered to the extent necessary to meet the training requirements. Abstract cuing features shall be designed to blend in with the natural, representational scene elements and to avoid a completely unreal appearance. In all cases, sufficient representational scene elements shall be used in conjunction with abstract elements to preserve the illusion of accuracy.

30.3.4.1.1.1.4 Artificial cues.

Artificial cues shall be used when other methods will not suffice. Artificial cues are scene elements whose primary cuing value is not derived from inherent visual characteristics, but instead arises from a pre-designed relationship to the simulated environment which is known to the trainee. Examples of this type of cue would be a special texture pattern and color to indicate a particular type of soil or an unusual building used to mark the point at which a turn should be initiated. The use of artificial cues shall be generally limited to situations which cannot be dealt with by other means.

30.3.4.1.1.2 Environment continuity and blending.

Scene realism shall not be degraded by discontinuities and inconsistencies in the environment models.

Discontinuities caused by differing data sources for adjacent areas, level of detail transitions, altitude changes, transition from specific to generic areas, atmospheric simulation or other causes, shall not occur. Techniques to blend dissimilar areas to achieve a smooth, natural appearing transition shall be employed. The techniques shall include modeled transition areas between terrain types, use of a gradual decrease in scene content between high and low level of detail areas.

30.3.5 Programmable parameters.

For parameters which are specified as being programmable, easily programmable, etc. a user friendly method of data input shall be provided for off-line use. This method is intended for parameters which would require only occasional changes. It shall be designed to permit instructors and non-technical personnel to edit problem parameters. A command file which used common English commands or a menu driven data entry program would be appropriate.

30.4 Not Used.

30.5 Not Used.

30.6 Not Used.

30.7 Major component characteristics.

30.7.1 Image generator subsystem.

The CCTT image generator subsystem shall consist of real-time computer image generation and image processing equipment. The computer image generation is considered to include that class of system which provides true perspective two dimensional displays of stored three dimensional environment database. Image processing refers to operations performed on pixel image data. It is applicable to the visual scene as seen through the periscopes, sights sensors and popped hatch of the vehicle modules and the CCTT console visual displays which depict the geometry and appearance of their environment. The system shall provide imagery for each module/console for all of the following which are applicable.

a. Vision blocks.

b. Weapon system sights and periscopes (those that magnify).

c. Thermal sensors.

d. Image intensifier night vision devices.

e. CCTT consoles, including binocular and NVG view.

f. After action review station, including a single large screen video projection system shared by the AAR consoles.

g. Popped hatch capability.

30.7.1.1 Image generation system throughput.

The primary measure of image generator speed is continuous image density. The number of polygons (or edges) per channel and other relevant system parameters shall be selected to meet that requirement. Since the demands on each type of channel vary considerably depending on its content and FOV and, since the ability to meet continuous image density requirements may depend more on the effectiveness of scene content management and database design than on polygon throughput, minimum capacity of potentially visible polygons for each channel as specified below is to be used as a baseline for defining continuous image density requirements. A significantly higher channel throughput in polygons may be required to achieve the required density. In each channel no less than 600 polygons per 40 degrees of true horizontal FOV shall be available for the display of the medium and high resolution terrain skins.

Potentially visible polygons are defined as the front facing, four sided surfaces that are either directly visible or would be visible if not occulted by an intervening scene element.

Potentially visible polygons (Minimum acceptable) = 1000 + [(Channel's true horizontal FOV) / 40] x 2500

The above values assume a highly effective scene content management system. If the image generator light point capacity is stated separately from (in addition to) polygon capacity then three light points are assumed equivalent to one polygon for up to ten percent of the required capacity if the lights can have reflectance characteristics and serve as point objects. The system shall have the capability to compute both light points and surfaces. If the number of pixel writes can limit system output, then a depth complexity of 2.7 (ability to write each pixel 2.7 times per field and frame) shall be provided. This number is based on efficient algorithms/processes which minimize redundant writes. Where less efficient algorithms/processes are utilized a compensating number of pixel writes is required. System and channel capacity throughout the image generator shall be adequate to support the specified polygon capacity for all operating conditions (that is, there shall be no computational, memory, data transfer, or other limitations anywhere in the image generator or the database design which would limit the ability of the system to display the specified quantity of potentially visible polygons). The polygon and pixel performance shall be independent of the number of channels generated by a single image generator. The polygon and pixel capacity shall be met regardless of the displayed image geometrical arrangement, distribution of polygons within the displayed image, number and distribution of moving models and the worst case combination of special processing and display features invoked. The polygon and pixel capacity shall not be restricted by polygon complexity attributes, i.e., texture, antialiasing and shading.

30.7.1.2 Displayed image artifacts.

Distracting artifacts caused by digital processing errors shall be minimized. The image generator design shall be used which minimizes the effect on the scene of errors which do occur. Anomalies shall in every case be eliminated or reduced to the extent that they shall not degrade the effectiveness of exercise execution. Attention shall be directed to limitations in sampled data processing in the spatial domain, color-intensity domain, and to resolution and accuracy limits caused by word length, round-off, truncation error, etc. Typical artifacts contributing to poor image quality that shall receive special emphasis in design for minimization include:

a. Temporal aliasing caused by interactions of scene elements with the raster structure.
b. Scintillation of small surfaces and of texture.
c. Quantization of continuous scene elements (e.g. stair-stepping and line-crawling of edges and breakup of long narrow surfaces).
d. Occulting errors, including transition pixels.
e. Flashing and streaking of entire polygons and scan line segments.
f. Abrupt transition of scene elements between adjacent pixels.
g. Abrupt changes in illumination, color or intensity (e.g., flicker, flashing, Mach bands, etc.).
h. Flashing and streaking by visual features due to logic errors and other causes.

30.7.1.2.1 Anti-aliasing.

Undesirable artifacts of digital image processing shall be eliminated or reduced to a negligible level for both surfaces and light points. Attention shall be directed to limitations in sampled data processing in the spatial, temporal, and color/intensity domains and to resolution and accuracy limits caused by word length, round-off and truncation error, and similar effects. Image processing shall be accomplished on the basis of display area as opposed to scanline computation. Intensity calculations shall be performed for not less than four subpixels per pixel. Isotropic spatial filtering, with a large number of samples, which accounts for image events in adjacent pixels shall be performed. Temporal aliasing such as field entrainment caused by the use of an interlaced raster shall be minimized through judicious selection of a filter function or other means. To minimize aliasing, specific design features shall be provided to minimize the following:

a. Scintillation of small surfaces.
b. Quantization of continuous scene elements (stair-stepping of edges, breakup of long narrow surfaces, etc.).
c. Abrupt transition of scene elements between adjacent pixels.
d. Occulting errors in transition pixels.
e. Abrupt changes in illumination/color/intensity (flicker, flashing, Mach bands, etc.).

30.7.1.3 Special image generator processing.

The system shall have sufficient special processing features such as shading, transparency, etc. to meet the functional and performance requirements herein. Shading shall be used on all polygons and objects in the database. Flat, fixed, and smooth surface shading shall be provided. Shading shall not result in any Mach band or other color discontinuities in smooth surfaces.

30.7.1.4 Texture.

The system shall be capable of mapping image data onto all environment polygons. In this specification image data refers to stored pixel (texel) data generated by both photographic means and numerical algorithms. The image data is referred to as photo-maps, cells, texture maps, texture patterns, etc. The effect of transparency, shading, illumination, and all other simulated characteristics specified for polygons shall be reflected in the mapped polygons. The image data shall provide intensity contour and modulation, color contour and modulation, transparency contour and modulation and full color texture. Contour mapping allows a pattern to depict a shape (silhouette) on a single polygon. Image data parameters shall be capable of being modulated independently, simultaneously, and as a function of range.

30.7.1.4.1 Mapping.

The image data shall be spatially fixed on the surfaces and shall display correct perspective and orientation as the viewpoint and mapped surface move in the environment. The texture shall remain fixed relative to the underlying polygons and shall be valid for all orientations of objects and polygons in the environment. The system shall be capable of:

a. Mapping an image (map) on a single polygon.

b. Mapping a single image (map) over multiple, continuous polygons.

c. Using a single map repeatedly to fill a single polygon.

Polygons shall be capable of being specified to always face the view point in azimuth for the efficient generation of trees and similar scene elements in the distant scene.

30.7.1.4.2 Anti-aliasing and blending.

The image data shall be blended at boundaries between repetitions and at boundaries between polygons, where appropriate, to prevent the boundaries and repetitions from being obvious. Resolution and dynamic range of texture shall be adequate to provide stable imagery throughout the operating range. The imagery shall be free of aliasing. Multiple levels of detail shall be used to maintain maximum image sharpness while avoiding noticeable interaction of the pixel and texel structures. The imagery shall be blended between maps during level of detail transitions. At least four levels of detail shall be used for all features which require viewing over a large dynamic range. The system shall also be capable of superimposing two geo-typical images in real time to provide clear detail at close viewing ranges while retaining the distant image. Texture map sizes of at least 512 X 512 shall be available.

30.7.1.4.3 Image data quantity.

A total of not less than 4 million texels of texture map data shall be capable of being stored in random access memory.

30.7.1.4.4 Image data retrieval.

Retrieval (paging) of image data in real time shall be provided to permit geo-typical and geo-specific photographic data to be used throughout the visual environment.

30.7.1.4.5 Dynamic texture.

Dynamic texture patterns shall be provided which have the capability to move in any direction on the surface to which it is applied to simulate moving ocean waves, clouds, blowing sand/snow, and similar effects.

30.7.1.4.6 Improved texture performance.

30.7.1.5 Database storage capacity.

Although only one database shall be in use (selected) at any given time on any given module/console, each module/console shall have enough mass storage capacity to simultaneously accommodate three complete databases, e.g., the three deliverable training environments. For the CCTT system, the time to activate any one of the three which are available shall be less than 5 minutes. At each module/console a means to replace one of the available databases with a new one in less than 3 hours shall be provided. For the CCTT system, there shall be a means provided for replacing databases on modules/consoles, by removable media, ie., magnetic tape, at each module/console.

30.7.1.6 Improved IG performance.

The image generator designs shall provide for straightforward upgrade by modular expansion of the system. Spare card slots shall be provided in the image generator for expansion flexibility. The image generator expansion capability shall allow for a much higher processing and storage capacity to provide coverage of larger areas with higher resolution data and increased density, for future support of the P3I improvements.

30.7.2 Image display subsystem.

The CCTT image display subsystems shall convert the signals from the image generator into visual images representing the simulated environment for each of the module/console displays as specified. The general module displays shall be installed in light-proof and dust-proof enclosures. The CCTT consoles shall be configured so as to prevent extraneous light from seriously degrading the quality of the displayed scene.

All optics used in the sights and optical paths shall be readily accessible to facilitate cleaning and adjustments.

30.7.2.1 Viewing volume and viewing distance.

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30.7.2.2 Optics.

All reflective optics used in the CCTT display subsystem shall be front surface reflective coated. The transmission and reflection of any beam-splitter utilized shall be maximized for signal to ghosting ratio both on and off axis. No chromatic or spherical aberration shall be discernible. Physical configuration of the display unit shall be optimized to the crew members compartment with a minimum of compartment modifications. A dustproof enclosure shall be provided for the optical subsystem. There shall be no major spurious images or reflections, including light leaks, mirror imperfections, and reflections, or from any other source.

30.7.2.3 Magnified displays.

Except where deviation is authorized, the magnified sight displays shall duplicate the magnification, real FOV and apparent FOV of the corresponding operational equipment for each module. The external appearance (from within the vehicle module) of the simulated sights shall have the form, fit and feel of the operational equipment. Displayed images which simulate selectable modes (optical/thermal) and magnification shall, when in optical mode, utilize the full horizontal and vertical resolution capability of the raster format regardless of the magnification selected (except where a portion of the field of view is masked to provide resolution representative of the device being simulated). For thermal mode operation an appropriate portion of the full raster format may be masked but the remaining unmasked part of the raster shall be used for all magnification options. As appropriate, based on the actual vehicle, sights and periscopes with magnification shall have eyepieces with the following characteristics:

a. Erfle design.

b. Diopter adjustment - +/- 2.5 Diopters.

c. Reticle focus (when appropriate, but not needed if reticle is generated by the CIG).

d. Eye relief - 25mm.

e. Exit pupil - 6mm.

f. Apparent field of view (AFOV) available - Shall be the same as that in the corresponding operational equipment. The part of the available AFOV which is actually filled with imagery (AFOV used) shall vary from sight to sight and from mode to mode (thermal versus optical) just as it does in the operational equipment.

30.7.3 Image database development system.

A database development system shall be provided. It shall be a separate, stand-alone system that uses none of the other CCTT system assets. The following features shall be provided in the database development system:

a. Full support for off-line model development without using any part of the real-time visual system to produce the run-time database.

b. Ability to import the Generic Terrain Databases (GTDB) of Project 2851 with automatic conversion to the native edit format of the image generator. (Required only if this capability is available with the database generation system developed for the image generator).

c. Automatic transformation of Project 2851 Standard Simulator Database Interchange Format (SIF) to the native edit format of the system and automatic transformation from native edit format to Project 2851 SIF. This capability shall enable the system to import and use SSDB data and enable databases developed for the training systems under this specification to be exported in the SIF format for incorporation into the SSDB.

d. Automatic transformation of DTED, DFAD and ITD into polygon feature models and gridded or polygon terrain models of the form required by the image generator.

e. Modification of all parameters of the database.

f. Generation of 2 and 3-dimensional models using data input by the operator from either stored data files or manual input. Automated tools to facilitate efficient modeling and allow generation of complex models using high level commands shall be included.

g. Digitizing photographic data from prints, transparencies and using a high resolution scanner.

h. Generation of numerical texture patterns from library algorithms used in developing the training database.

i. Image processing functions required to prepare texture and geo-typical photographic data for accurate mapping onto polygons.

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k. Ability to efficiently merge data from diverse sources and add enriching three dimensional detail in a semi-automated fashion including locating three dimensional models on all terrain without unnatural constraints in positioning.

l. Ability to translate the resulting database into the format(s) required for use on the 1) Plan View Systems associated with the After Action Review, CES and SAF consoles and 2) any other consoles requiring a version of the database.

m. Ability to use the resulting visual environment database to create all the information (e.g., contour lines, drainage features, and cultural features) required by cartographers to produce full color 1:50,000 scale maps. The information must be of such quality that said maps shall fully meet DMA standards for such maps (MIL-T-89301) and, when produced, be in full agreement with the source visual environment. The information shall be provided in a form readily usable by cartographers. All hardware and software required to generate the information shall be provided.

n. Any other functions required to produce a database equivalent to the training databases provided with this system.

30.7.4 Visual and sensor image database.

A stored digital representation of the training environment imagery shall be provided. The database shall be provided in both source and executable forms. It shall include all image data, polygon and object definition data, and all other data required to describe, define, and control the visual and sensor scenes required by this specification. Real time software which produces the scenes is not considered a part of the database. The same geometric definitions and object characteristics shall be used for the visual and sensor databases to the extent that object occurrence, object appearance, object location, terrain shape, terrain elevation, surface material and other environment characteristics are the same as discernible by the trainees using the simulated viewing capability. The database fidelity shall be sufficient to enable the complete visual and sensor simulation system to meet all of the performance requirements of this specification. The database development process shall provide a capability whereby each completed visual database is automatically translated into the executable form required for use on the CCTT Plan View Systems, SAF and the visual environment feedback processing systems of the emulation consoles. Versions for the visual system, SAF, the plan view systems, sensor image systems and visual environment feedback processing systems of the emulation consoles shall be provided for each deliverable database required herein.

30.7.4.1 Deliverable training environments.

Three training environments shall be supplied. Two training environments shall be full up CCTT environments (primary environments), which are capable of supporting the specified training capability and meeting all other specific performance requirements herein. Each of the primary environments shall represent at least a 100 km X 150 km gaming area. For each primary environment, maps which conform to the DMA standards for 1:50,000 topographic maps shall be developed and provided.

30.7.4.1.1 Primary environments.

One database for temperate forest and another for desert shall be provided.

A complexity level consistent with the terrain and feature characteristics based on real world data of central Germany with SW corner co-ordinates of 50-38-49.7 degrees E, 08-11-37.7 degrees N and NE corner co-ordinates of 51-59-48.9 degrees E and 09-39-19.4 degrees N shall be provided for the temperate forest database. Man made features in the temperate forest visual data base shall be characteristic of those found in the United States. The complexity level consistent with the terrain and feature characteristics of the Army's National Training Center at Fort Irwin based on real world data with SW corner coordinates of 117 degrees W, 34-15.0 degrees N and NE corner coordinates of 116-15.0 degrees W, 35-45.0 degrees N shall be provided in the desert database. Each environment shall be a continuous representation of terrain elevation, terrain features (trees, rivers, soil type, etc.) and cultural data. Customization shall be required to smoothly blend the different levels of required terrain resolution, and the features comprising each environment, e.g., connect and/or continue rivers, roads, power lines and hilly areas, to avoid unrealistic discontinuities. The database development process shall provide a hard copy printout of the terrain skinning statistics of the source data and resulting skin for comparison purposes. When skinning the terrain, in no case shall the difference in absolute elevation values for corresponding points for 90% of the terrain area be greater than 20 meters in the Primary 1 database or greater than 10 meters in the Primary 2 database. The terrain surface elevation difference shall be within 2.5 meters for the corresponding source grid for 40 percent of the terrain area in Primary 1 database and for 60 percent of the terrain area in Primary 2 database.

As required, the boundaries between the coarse, medium and high regions shall be blended to eliminate discontinuities and unnatural looking terrain and features.

Each deliverable visual environment (terrain, features, vehicle models and special effects) shall be provided in Project 2851 Standard Interchange Format (SIF) so as to be usable on other programs. For each deliverable visual database the following map information shall be provided:

a. Set of Check Plots.

b. Ready to print map information files for each map sheet in encapsulated postscript format.

c. Map labels contained in a text file, readable by the electronic map generation software.

d. Ready to print map information file(s) ESRI ARC/Info map coverage format.

e. The entire geographic area of the corresponding database shall be represented.

f. The provided scale shall be 1:50,000 and a government specified special site map for the desert database.

g. The map set shall comply with DMA standards MIL-T-89301. Exceptions to the DMA standard shall be permitted as required to make effective use of the automated map generation tools, subject to approval by the Database Working Group and the Government.

h. Terrain and feature data existing in the visual database which would appear on the ”real world” DMA maps shall be depicted.

All terrain and feature characteristics of a given database which would be depicted on equivalent real world maps shall be depicted on the delivered maps. The maps shall include all the information required by the aforementioned map specifications, e.g., legends, symbols, place names, contour lines and grids. The maps shall not contain elevation and feature information not present in the visual environment. A map set for each deliverable database shall be provided with every module/console. A set of reproducibles for the maps associated with each deliverable database shall be provided.

30.7.4.1.1.1 Database source data.

The database development effort shall include an automated process for developing the coarse and medium terrain skins from DMA level 2 data. The DTED level 2 data shall be obtained from DMA. The source elevation data for the high resolution terrain shall be provided by the contractor. Agreement between the source data and the associated coarse and medium terrain skins shall be based on capturing the essence of the terrain roughness not the exact terrain elevation. The essential characteristics of the source terrain data, i.e., hills, mountains, ridgelines, valleys, plains, etc. shall be replicated by the terrain skin. Additionally, photographs, maps and other data shall be used as required to achieve the required scene content and detail. Photographic data and high detail maps shall be used to determine local environment characteristics.

The source for the feature data shall be maps, books, photographs and DMA data, DFAD and ITD. All information represented on real world DMA 1:50,000 maps shall be depicted in the visual environment. Additional terrain characteristics and features which are of tactical importance and which contribute to cover and concealment and trafficability shall be added where map detail is sparse.

30.7.4.1.2 Secondary environment.

Deleted.

30.7.4.1.2.1 Database source data.

Deleted.

30.7.4.1.3 Deliverable general use models.

The models listed in table A-1 shall be provided for general use in the primary environments.

30.7.4.2 Detailed training environment and model requirements.

30.7.4.2.1 Training environments.

For real world regions, the simulated earth's surface (terrain skin) shall be derived per 30.2.1.1.2.1 and overlaid with two-dimensional, geo-typical photo-texture. Three-dimensional features for real world regions shall be placed on the terrain surface according to the capture criteria below and up to the limit imposed by the specified continuous image density.

30.7.4.2.1.1 Modeling the real world.

30.7.4.2.1.1.1 Feature models for real world.

Descriptive information for modeling the individual features shall be derived from more detailed charts, photographs, and other information which accurately depict the features. Two-dimensional representations of small three-dimensional features are acceptable where correct appearance and viewing range (considering displayed resolution) is maintained.

30.7.4.2.1.1.2 Real world feature capture criteria.

The capture criteria is defined relative to features depicted on maps. All information from ITD shall be incorporated in the database as appropriate as determined by government review. Scene continuity shall be preserved by ensuring that small elements of features such as narrow sections of large rivers are included. Additional real-world and generic fill-in details shall be incorporated into the scene so that the specified minimum continuous image density is maintained. In regions where recognizable map detail is sparse, such as deserts, the capture criteria shall be made more stringent to enable the navigation tasks.

a. Roads and highways:
   (1) On 1:50,000 maps includes all roads from divided highways through light duty, all weather, hard or improved surface roads.
   (2) Connecting roads and interchanges which contribute to a recognizable pattern.
b. Villages, towns, and cities. Three-dimensional buildings are required over a minimum of 16 square block areas where the area is comprised of a high density of multistory buildings. Each city complex shall be unique although it may be composed of common library objects and sets. Geo-typical photo texture shall be used on the building sides.
c. Airports. Generic representation may be used if runway pattern and heading are correct.
d. Agricultural buildings and complexes.

e. Race tracks and other elevated structures.

f. Bridges depicted in 1:50,000 maps, and causeways and elevated roads more than ½ mile in length.

g. The cleared strip around electrical transmission lines, and the electrical transmission towers and lines with and without the orange obstruction balls.

h. TV and microwave relay towers.

i. Railroads.

j. Industrial complexes outside populated areas.

k. Coastline, waterways and islands. Vertical banks on waterways more than 10 ft wide and dry river beds with vegetation along the sides shall be provided. Components may be comprised of generic segments. The following detail shall be maintained:

   (1) All distinctive features and unusual shapes which are readily recognized.

   (2) Intercoastal waterways.

   (3) Rivers, swamps, channels and other waterways.

   (4) Canals, levees, dams and man made waterways.

   (5) Isolated dams, jetties, canals and levees.

   (6) Bays and river mouths.

   (7) Individual islands and groups of smaller islands.

l. Special unique features. The scene shall include unique visual features which are important because of their distinctive appearance, their unusual location or other characteristics, or their use as landmarks or navigation checkpoints. The correct map context shall be preserved even if additional features which do not meet the normal capture criteria must be incorporated (for example, a small lake beside a town).

m. Additional three-dimensional details, see 30.7.4.3.4, to provide speed cues.

n. Vegetation and wooded areas.

o. Soil type for environment feedback processing and determining geo-typical texturing.

[Performance goal - Capture all the terrain and feature data on 1:50,000 maps.]

30.7.4.2.2 Library models.

Library models of frequently encountered visual features shall have sufficient detail to permit their recognition and description by the observers, but they shall not contain excess detail which uses resources needed to include a larger number of features in the scene. To the maximum extent practical, feature detail shall be provided using stored image data.

30.7.4.2.3 General use models.

The following requirements apply to all models of the types indicated.

Commercial publications, military manuals, manufacturer data or other appropriate materials shall be used to determine vehicle appearance. Models shall be suitable for multiple uses in various locations throughout the gaming area.

a. Vehicles - Friendly and hostile vehicles shall be modeled with sufficient detail to permit recognition and identification within the limits imposed by visual resolution. Modeling emphasis of the vehicles shall be on overall shape and significant identifying details. Vehicle parts which can move independently of the vehicle such as gun tubes and which are relevant to the training problem shall be separately articulated in the models. Friendly vehicles shall utilize the combat vehicle marking system to distinguish between vehicles.

b. Aircraft - Friendly and hostile aircraft shall be modeled with sufficient detail for recognition and identification within the limits imposed by visual resolution. Modeling emphasis of the aircraft shall be on overall shape and significant identifying details. Aircraft parts which can move independently of the vehicle such as rotors and which are relevant to the training problem shall be separately articulated or given a realistic appearance in the models.

c. Weapon emplacements - Friendly and hostile weapon emplacements (e.g., artillery, missiles, rockets, mortar) shall be modeled with sufficient detail for recognition and identification within the limits imposed by visual resolution. For weapons emplacements, photographic image data shall be used in the models to ensure realistic detail when viewed at close range or with magnified sights.

d. Troops - Friendly and hostile troops shall be modeled with sufficient detail for recognition and identification within the limits imposed by visual resolution. The troops shall be modeled in five arrangements to be specified during database design reviews. These would typically include a wedge, line and column formation. Each troop formation shall have three stances: standing, kneeling and prone. Photographic image data shall be used in the troop models to ensure realistic detail when viewed at close range or with magnified sights. Friendly troops shall utilize a marking system.

30.7.4.3 General database requirements.

Each database shall be designed to support the scene content management and image density performance requirements. CCTT is a ground based application requiring a very dense scene; this while striving to minimize the cost image generation system creates the need for a sophisticated database design in order to ensure that maximum performance is achieved from the image generator. Because of the role of features on the earth’s surface in providing cover and concealment and in limiting the range of vision, the database shall provide equivalent characteristics to the areas being simulated. The tactically significant characteristics of the environment shall be accurately portrayed. The database shall provide the features required to support evasive maneuvering, including dodge and hide movements to avoid anti-armor missiles. The database(s) shall provide routes that cover and conceal a vehicles’ movement consistent with the contour interval of the associated 1:50,000 map. Vehicle movement through the database shall be unrestricted except where the restriction is consistent with the trafficability aspects of the database, e.g., buildings, trees, deep waterways, etc., and vehicle characteristics.

30.7.4.3.1 Application specific design.

The design shall take advantage of the characteristics of the visual environment in each part of the database, the low viewpoint of the observers, and natural restraints on human vision in the environment. Design methods used in each region of the database shall be appropriate for that area. Scene elements which are not map specific shall be designed to facilitate a high density of visual features and to maintain an overall visual environment consistent with the area being simulated. Fence row vegetation, wooded areas, and other features which are typical of the region being simulated shall be arranged to limit viewing range to be similar to that typical of the area and to prevent system overload by allowing unneeded scene elements to be removed from processing.

a. Hierarchical structure. Each database shall utilize a hierarchical structure which facilitates development and processing efficiency. There shall be sufficient numbers of hierarchical subdivisions in the database (i.e., number of objects, segments, groups, etc.) to preclude limiting image complexity. The hierarchical database structure shall allow both local concentrations of high database density and less dense scenes covering large areas in the same database, which can be displayed at the same time. The hierarchical database design shall allow control of the database by the real-time system at all levels of the hierarchy.

b. Level of detail. As a general rule, multiple levels of detail shall be used for all models. It shall be possible to apply multiple levels of detail at different levels of the database hierarchy. Level of detail transitions shall be both range and FOV, i.e., magnification, dependent. The location, shape, and size of adjacent level of detail representations shall be the same so that the integrity of all exercise activities is maintained.

c. Types of information depicted. Each database shall be designed to provide each trainee with all of the visual and sensor information normally available in the real world situation which is relevant to the military activities. The following list is typical of the database descriptors necessary to provide the required visual information.

    (1) Color.

    (2) Temperature.

    (3) Surface material.

    (4) Constraints to movement.

    (5) Surface condition (wet, dry, temperature, firmness, etc.).

    (6) Height and size of vegetation.

    (7) Depth of hydrographic features.

    (8) Scene content control information.

    (9) Location, size and shape of features.

30.7.4.3.2 Use of image data and texture.

Texture and image data shall be used throughout each database to enhance the information content of scene elements and to add realism to their appearance. The primary purpose of image data shall be to accurately convey information about the environment and the tactical situation. The image data shall provide the following:

a. Indicate surface material and significant surface characteristics which can normally be detected visually or with the simulated sensors.

b. Have a characteristic depth and height to provide the same degree of cover and concealment as in the real world and indicate the degree of cover available to operating units.

c. Have a characteristic ”passability” which indicates to the viewer the ease with which the terrain can be traversed and has a corresponding effect of unit movement capability.

d. Depict sub-polygon shape variations such as rocky ground.

e. Depict complex features with minimum polygon content through the use of photographic imagery on simple polygon models.

f. Represent complex arrays and patterns of natural and cultural features in the distant scene.

g. Geo-typical image data which has the correct appearance for the surface material and geographic area being simulated.

h. DELETED.

i. Replacement of 3 dimensional representations with geo-typical image data as a level of detail change for complex features.

30.7.4.3.3 General scene data.

General scene detail shall be used to preserve the general appearance of the environment being simulated and provide speed and distance cues. This shall include field patterns and divisions and features such as hilltops, valleys, saddles, ridges, depressions, gullies, streams, trails, hillocks, mountains, rivers, fords, forests, roads, man-made structures, and vegetation features.

30.7.4.3.4 Generic fill-in and scene enrichment.

Generic fill-in andscene enrichment including two-dimensional texture shall be incorporated throughout the visual environments specified herein to provide the visual feature density and resulting visual cue content necessary to perform the training tasks when real-world features alone are not sufficient. Generic fill-in features shall be designed to be compatible with the geographic area in which they will be employed to maximize visual information to the trainee. In the generic fill-in areas, the trees height shall vary with pseudo-random distribution of intermediate heights or agree with the tree height value(s) accepted by the government representative in the terrain component review meetings. In the generic fill-in areas, the density of the trees shall not be less than 150 objects per square kilometer. In the generic fill-in areas, the vegetation, bushes, and rocks shall be provided and shall have an object density of 1000 per square kilometer and a representative size variation.

30.7.4.3.5 Database compatibility.

All databases produced under this specification shall be capable of operation with all visual systems under this specification. The locations and characteristics of terrain and feature data shall be consistent (correlated) throughout the CCTT system.

30.7.5 Operating and maintenance software and hardware.

Software and hardware shall be provided to permit efficient operation, test and maintenance of the system

Vehicle Composition Table

Table II-A-I. contains the Vehicle Composition Table. A description of each column is included as follows:

- Platform Name. Designates the specific vehicle to be simulated.
- Hull Type. Identifies the hull model to be used. Valid entries include:
    - Tracked Hull
    - Wheeled Hull
    - Fixed Wing Aircraft (FWA)
    - Rotary Wing Aircraft (RWA)
    - Missile,
    - Dismounted Infantry (DI)
- Weapon Name. Designates the specific weapon to be simulated.
- Weapon Type. Identifies the weapon model to be used. Valid entries include:
    - Missile (guided)
    - Rocket (non-guided)
    - Ballistic Weapon (guns, mortars, etc.)
- Munition. Designates the specific munition to be simulated.
- Sensor Name. Designates the sensor positions to be simulated Valid entries include:
    - Vision Blocks (driver's block, commander's block . . .)
    - Sights (gunner's sight, commander's sight . . .), etc.
- Sensor Type. Identifies the sensor model to be used. Valid entries include:

- Visual
- Thermal (Infrared)
- Image Intensification (I2, NVG)

- Resources. Identifies the type of resources available for the platform. Valid entries include:

- Fuel
- Ammo
- Cargo (Dismounted Infantry (DI), Fuel, Ammo, Attachments)

• Articulated Parts. All components of a vehicle that have the capability to be articulated by SAF/CGF.

• Degrees of Freedom. Identifies the degree of freedom modeled for the articulated part.

Table A-I. Vehicle Composition Table

Platform Name	Hull Type	Weapon Name	Weapon Type	Munition	Sensor Name	Sensor Type	Resources	Articulated Parts	Degrees of Freedom
M1A1	Tracked	120mm Cannon (Main Gun)	Ballistic	APFSDS-T M829A1	Driver Block	Visual	Fuel	120mm Cannon (Main Gun)	Pitch
						I^2			
				HEAT-MP-T M830	Loader Block	Visual	Ammo	.50 Caliber MG (Commander)	Pitch
				HEAT-MPAT M830E1	Commander Block	Visual		7.62mm MG (Coaxial)	**Pitch
		.50 Caliber MG (Commander)	Ballistic	.50 Caliber Ball/Tracer		I^2 (NVG)		Primary Turret	Heading
		7.62mm MG (Coaxial)	Ballistic	A141 Ball / Tracer	Gunner Sight	Visual		Secondary Turret	Heading
						Thermal			
		Smoke Grenade Launchers	Ballistic	L8 A3 RP Smoke Grenades					
M1A1 w/ mine rollers	Tracked	120mm Cannon (Main Gun)	Ballistic	APFSDS-T M829A1	Driver Block	Visual	Fuel	120mm Cannon (Main Gun)	Pitch
						I^2			
				HEAT-MP-T M830	Loader Block	Visual	Ammo	.50 Caliber MG (Commander)	Pitch
				HEAT-MPAT M830E1	Commander Block	Visual		7.62mm MG (Coaxial)	** Pitch
		.50 Caliber MG (Commander)	Ballistic	.50 Caliber Ball/Tracer		I^2 (NVG)		Primary Turret	Heading
		7.62mm MG (Coaxial)	Ballistic	A141 Ball / Tracer	Gunner Sight	Visual		Secondary Turret	Heading
						Thermal			
		Smoke Grenade Launchers	Ballistic	L8 A3 RP Smoke Grenades					
M1A1 w/ mine plows	Tracked	120mm Cannon (Main Gun)	Ballistic	APFSDS-T M829A1	Driver Block	Visual	Fuel	120mm Cannon (Main Gun)	Pitch
						I^2			
				HEAT-MP-T M830	Loader Block	Visual	Ammo	.50 Caliber MG (Commander)	Pitch
				HEAT-MPAT M830E1	Commander Block	Visual		7.62mm MG (Coaxial)	** Pitch
		.50 Caliber MG (Commander)	Ballistic	.50 Caliber Ball/Tracer		I^2 (NVG)		Primary Turret	Heading
		7.62mm MG (Coaxial)	Ballistic	A141 Ball / Tracer	Gunner Sight	Visual		Secondary Turret	Heading
						Thermal			
		Smoke Grenade Launchers	Ballistic	L8 A3 RP Smoke Grenades					
M1A2	Tracked	120mm Cannon (Main Gun)	Ballistic	APFSDS-T M829A1	Driver Block	Visual	Fuel	120mm Cannon (Main Gun)	Pitch
						Thermal			
				HEAT-MPAT M830	Loader Block	Visual	Ammo	.50 Caliber MG (Commander)	Pitch
				HEAT-MP-T M830E1	Commander Block	Visual		7.62mm MG (Coaxial)	** Pitch
		.50 Caliber MG (Commander)	Ballistic	.50 Caliber Ball/Tracer	Gunner Sight	Visual		Primary Turret	Heading
		7.62mm MG (Coaxial)	Ballistic	A141 Ball /		Thermal		Secondary Turret	Heading

				Tracer					
		Smoke Grenade Launchers	Ballistic	L8 A3 RP Smoke Grenades	Commander Sight (CITV)	Visual			
						Thermal			
M1	Tracked	105mm Cannon (Main Gun)	Ballistic		Driver Block	Visual	Fuel	105mm Cannon (Main Gun)	Pitch
				APFSDS-T M833		I^2	Ammo	Turret	Heading
					Loader Block	Visual		NOTE: .50 caliber is not listed because the M1 is for SIMNET computerability only. SIMNET DOES NOT SUPPORT MACHINE GUN FIRE!!!	
					Commander Block	Visual			
				HEAT-MP-T M456A2		I^2 (NVG)			
				.	Gunner Sight	Visual			
						Thermal			
M2A2 IFV	Tracked	25mm Cannon (Main Gun)	Ballistic	APFSDS-TM919	Driver Block	Visual	Fuel	25mm Cannon (Main Gun)	Pitch
								Turret	Heading
				HE-I-T M792		I^2	Ammo	7.62mm MG (Coaxial)	** Pitch
		7.62mm MG (Coaxial)	Ballistic	A141 Ball/Tracer	Gunner Sight	Visual	DI	TOW Missile Launcher	Pitch
		TOW Missile Launcher	Missile	ATGM TOW II-BGM71D		Thermal			
		Smoke Grenade Launchers	Ballistic	L8 A3 RP Smoke Grenades	Commander Block	Visual			
M2A2 BSFV	Tracked	25mm Cannon (Main Gun)	Ballistic	APFSDS-TM919	Driver Block	Visual	Fuel	25mm Cannon (Main Gun)	Pitch
								Turret	Heading
				HE-I-T M792		I^2	Ammo	7.62mm MG (Coaxial)	** Pitch
		7.62mm MG (Coaxial)	Ballistic	A141 Ball/Tracer	Gunner Sight	Visual	DI	TOW Missile Launcher	Pitch
		TOW Missile Launcher	Missile	ATGM TOW II-BGM71D		Thermal			
		Smoke Grenade Launchers	Ballistic	L8A1/A3 RP Smoke Grenades	Commander Block	Visual			
						Thermal			
M3A2, CFV	Tracked	7.62mm MG (Coaxial)	Ballistic	A141 Ball/Tracer	Commander Block	Visual	Fuel	7.62mm MG	** Pitch
		25mm Cannon	Ballistic			Thermal	Ammo	25mm Cannon	Pitch
				APFSDS-T M919				Turret	Heading
				HE-I-T M792	Gunner Sight	Visual	DI	TOW Missile Launcher	Pitch
		TOW Missile Launcher	Missile	ATGM TOW II-BGM71D		Thermal			
					Driver Block	Visual			
						I^2			
M113A3 CAR PERS	Tracked	.50 Caliber MG	Ballistic	.50 Caliber Ball/Tracer	Driver Block	Visual	Fuel	.50 Caliber MG	Pitch
		Smoke Grenade Launchers	Ballistic	L8 A3 RP			Ammo	Turret	Heading

				Smoke Grenades					
						I^2 (NVG)	DI		
					Commander Block	Visual			
						I^2 (NVG)			
M113	Tracked	.50 Caliber MG	Ballistic	.50 Caliber Ball/Tracer	Driver Block	Visual	Fuel	.50 Caliber MG	Pitch
		Smoke Grenade Launchers	Ballistic	L8 A3 RP Smoke Grenades		I^2	Ammo	Turret	Heading
					Commander Block	Visual			
M981, FISTV	Tracked	Smoke Grenade Launchers	Ballistic	L8 A3 RP Smoke Grenades	Driver Block	Visual	Fuel	7.62 mm MG (M60)	Pitch
						I^2	Ammo	Turret	Heading
		7.62 mm MG (M60)	Ballistic	A141 Ball/Tracerr	Commander Block	Visual			
						I^2			
					Gunner Block	Visual			
					Gunner Sight	Thermal			
M966 HMMWV w/ TOW	Wheeled	Tow Missile Launcher	Missile	TOW II Missile	Driver Block	Visual I^2	Fuel	Tow Missile Launcher	Pitch
					Gunner Sight	Visual			Heading
						Thermal			
M998 HMMWV STINGER TM	Wheeled	N/A	N/A	N/A	Driver Block	Visual	Fuel	N/A	N/A
						I^2	DI		
M1025 HMMWV, TRK UTIL Configuration #1	Wheeled	.50 Caliber MG(M2)	Ballistic	.50 Caliber Ball/Tracer	Driver Block	Visual	Fuel	.50 Caliber MG	Pitch
						I^2	DI		Heading
							Ammo		
M1025 HMMWV, TRK UTIL Configuration #2	Wheeled	7.62mm MG (M60)	Ballistic	Ball, Tracer	Driver Block	Visual	Fuel	7.62mm MG	Pitch
						I^2	DI		Heading
							Ammo		
M1025 HMMWV, TRK UTIL Configuration #3	Wheeled	M249 (SAW) 5.56 mm	Ballistic	5.56 Ball/Tracer Linked	Driver Block	Visual	Fuel	M249 SAW	Pitch/Heading
						I^2	DI		
							Ammo		
M1025 HMMWV, TRK UTIL Configuration #4	Wheeled	MK-19 40mm Grenade Launcher	Ballistic	40mm Grenade	Driver Block	Visual	Fuel	MK-19	Pitch/Heading
						I^2	DI		
							Ammo		
M1043 HMMWV ARM CAR w/MK19	Wheeled	MK19 40mm Grenade Launcher	Ballistic	40mm Grenade	Driver Block	Visual	Fuel	MK19 40mm Grenade Launcher	Pitch/Heading
						I^2	Ammo		
							DI		
M1044 HMMWV ARM CAR w/M2	Wheeled	M2 .50 Caliber MG	Ballistic	.50 Caliber MG ammo	Driver Block	Visual	Fuel	M2 .50 Caliber MG	Pitch/Heading
							Ammo		
							DI		
M977 HEMTT Cargo w/ Mine Plow	Wheeled	N/A	N/A	N/A	Driver Block	Visual	Fuel	N/A	N/A
							Cargo		
M985 HEMTT Cargo w/ Mine Plow	Wheeled	N/A	N/A	N/A	Driver Block	Visual	Fuel	N/A	N/A
							Cargo		
M977 HEMTT Cargo w/ Mine Rollers	Wheeled	N/A	N/A	N/A	Driver Block	Visual	Fuel	N/A	N/A

							Cargo		
M985 HEMTT Cargo w/ Mine Rollers	Wheeled	N/A	N/A	N/A	Driver Block	Visual	Fuel	N/A	N/A
							Cargo		
M93 NBC RECON VEH	Wheeled	N/A	N/A	N/A	Driver Block	Visual	Fuel	N/A	N/A
DI SCT TEAM MEMBER 1	DI	5.56mm MG (M249)	Ballistic	Ball / Tracer Linked	DI Block	Visual	Ammo	5.56mm MG (M249)	Pitch/Heading
DI SCT TEAM MEMBER 2	DI	5.56mm (M-16A2)	Ballistic	Ball	DI Block	Visual	Ammo	5.56mm (M-16A2)	Pitch/Heading
				Tracer					
DI DRAGON TEAM MEMBER 1 Configuration #1	DI	5.56mm (M-16A2)	Ballistic	Ball	DI Block	Visual	Ammo	5.56mm (M-16A2)	Pitch/Heading
				Tracer	Gunner Sight	Visual		Dragon Missile Launcher	Pitch/Heading
		Dragon Missile Launcher	Missile	Dragon Missile		Thermal			
DI DRAGON TEAM MEMBER 1 Configuration #2	DI	5.56mm (M-16A2)	Ballistic	Ball	DI Block	Visual	Ammo	5.56mm (M-16A2)	Pitch/Heading
				Tracer	Gunner Sight	Visual		Javelin Missile Launcher	
		Javelin Missile Launcher	Missile	Javelin Missile		Thermal			
DI DRAGON TEAM MEMBER 2 Configuration #1 & #2	DI	5.56mm (M-16A2)	Ballistic	Ball	DI Block	Visual	Ammo	5.56mm (M-16A2)	Pitch/Heading
				Tracer					
DI INF FIRE TM MEMBER 1 Configuration #1 & #2	DI	5.56mm (M-16A2)	Ballistic	Ball	DI Block	Visual	Ammo	5.56mm (M-16A2)	Pitch/Heading
				Tracer	Gunner Sight	Visual		AT-4 66mm Rocket Launcher	Pitch/Heading
		AT-4 84mm Rocket Launcher	Rocket	66mm Rockets		I^2			
DI INF FIRE TM MEMBER 2 Configuration #1	DI	5.56mm (M-16A2)	Ballistic	Ball	DI Block	Visual	Ammo	5.56mm MG (M-16A2)	Pitch/Heading
				Tracer	Gunner Sight	Visual		Dragon Missile Launcher	Pitch/Heading
		Dragon Missile Launcher	Missile	Dragon Missile		Thermal			
DI INF FIRE TM MEMBER 2 Configuration #2	DI	5.56mm (M-16A2)	Ballistic	Ball	DI Block	Visual	Ammo	5.56mm MG (M-16A2)	Pitch/Heading
				Tracer	Gunner Sight	Visual		Javelin Missile Launcher	
		Javelin Missile Launcher	Missile	Javelin Missile		Thermal			
DI INF FIRE TM MEMBER 3 Configuration #1 & #2	DI	5.56mm MG (M249)	Ballistic	Ball/Tracer Linked	DI_Block	Visual	Ammo	5.56mm MG (M249)	Pitch/ Heading
						I^2			
DI INF FIRE TM MEMBER 4 Configuration #1	DI	5.56mm MG (M249)	Ballistic	Ball/Tracer Linked	DI Block	Visual	Ammo	5.56mm MG (M249)	Pitch/ Heading
						I^2			
DI INF FIRE TM MEMBER 4 Configuration #2	DI	5.56mm (M-16A2)	Ballistic	Ball	DI Block	Visual	Ammo	5.56mm MG (M-16A2)	Pitch/ Heading
				Tracer		I^2			
		40mm Grenade Launcher (M203)	Ballistic	40mm Grenade					
DI STINGER TEAM MEMBER 1	DI	5.56mm (M-16A2)	Ballistic	Ball	DI Block	Visual	Ammo	5.56mm MG (M-16A2)	Pitch/Heading
				Tracer				ADM Stinger	Pitch/

								Missile Launcher	Heading
		ADM Stinger Missile Launcher	Missile	Stinger Missile					
DI STINGER TEAM MEMBER 2	DI	5.56mm (M-16A2)	Ballistic	Ball	DI Block	Visual	Ammo	5.56mm (M-16A2)	Pitch/ Heading
				Tracer					
AH64A APACHE Configuration #1	RWA	M230E1 30mm Cannon	Ballistic	AP	Driver (Pilot) Block	Visual	Fuel	M230E1 30mm MG	Pitch/ Heading
				HE		Thermal	Ammo		
		M261 (2.75" ARCS)	Rocket	2.75" Rockets	Gunner Block	Visual			
		M272 (PTWS)	Missile	AGM Hellfire		Thermal			
AH64A APACHE Configuration #2	RWA	M230E1 30mm Cannon	Ballistic	AP	Driver (Pilot) Block	Visual	Fuel	M230E1 30mm MG	Pitch/ Heading
				HE		Thermal	Ammo		
		M272 (PTWS)	Missile	AGM Hellfire	Gunner Block	Visual			
						Thermal			
AH64A APACHE Configuration #3	RWA	M230E1 30mm Cannon	Ballistic	AP	Driver (Pilot) Block	Visual	Fuel	M230E1 30mm MG	Pitch/ Heading
				HE		Thermal	Ammo		
		M261 (2.75" ARCS)	Rocket	2.75" Rockets	Gunner Block	Visual			
						Thermal			
AH1S COBRA	RWA	M261 (2.75" ARCS)	Rocket	2.75" Rockets	Driver (Pilot) Block	Visual	Fuel	N/A	N/A
		20mm Auto Cannon	Ballistic	20mm Ammo			Ammo		
		Tow Missile Launcher	Missile	Tow II missile					
UH60 BLACKHAWK	RWA	N/A	N/A	N/A	Driver (Pilot) Block	Visual	Fuel	N/A	N/A
							DI		
UH60 BLACKHAWK w/SLING	RWA	N/A	N/A	N/A	Driver (Pilot) Block	Visual	Fuel	N/A	N/A
							DI		
OH58D KIOWA SCOUT	RWA	Hellfire Missile Launchers	Missile	Hellfire Missile	Pilot Block	Visual	Ammo	N/A	N/A
						Thermal	Fuel		
					Co-Pilot Block	Visual			
GER LEO II MBT w/120MM	Tracked	120mm Main Gun	Ballistic	APFSDS M829A1	Driver Block	Visual	Fuel	120mm Main Gun	Pitch
				HEAT M830	Loader Block	Visual	Ammo	7.62mm Coaxial MG	**Pitch
		7.62mm Coaxial MG	Ballistic	A141 Ball/Tracer	Commander Block	Visual		Turret	Heading
						I^2			
					Gunner Sight	Visual			
						Thermal			
GER LEO 1A4 MBT 105MM	Tracked	105mm Main Gun	Ballistic	APFSDS M833	Driver Block	Visual	Fuel	105mm Main Gun	Pitch
				HEAT M456A2	Loader Block	Visual	Ammo	7.62mm Coaxial MG	**Pitch
		7.62mm Coaxial MG	Ballistic	A141	Commander Block	Visual		Turret	Heading
						I^2			
					Gunner Sight	Visual			
						Thermal			
UK CHIEFTAIN	Tracked	120mm Main Gun	Ballistic	APFSDS-T M829A1	Driver Block	Visual	Fuel	120mm Main Gun	Pitch
				HEAT M830	Loader Block	Visual	Ammo	7.62mm Coaxial MG	**Pitch
		7.62mm Coaxial MG	Ballistic	A141	Commander Block	Visual		7.62mm Commander MG	Pitch
						I^2		Primary Turret	Heading
		7.62mm Commander MG	Ballistic	A141	Gunner Sight	Visual		Secondary Turret	Heading

						Thermal			
UK CHALLENGER	Tracked	120mm Main Gun	Ballistic	APFSDS-T M829A1	Driver Block	Visual	Fuel	120mm Main Gun	Pitch
				HEAT M830	Loader Block	Visual	Ammo	7.62mm Coaxial MG	**Pitch
		7.62mm Coaxial MG	Ballistic	A141	Commander Block	Visual		7.62mm Commander MG	Pitch
						I^2		Primary Turret	Heading
		7.62mm Commander MG	Ballistic	A141	Gunner Sight	Visual		Secondary Turret	Heading
						Thermal			
FR AMX30 MBT	Tracked	105mm Main Gun	Ballistic	APFSDS-T M833	Driver Block	Visual	Fuel	105mm Main Gun	Pitch
				HEAT M456A2	Commander Block	Visual	Ammo	20mm Cannon (Coaxial)	**Pitch
		20mm Cannon (Coaxial)	Ballistic	AP/HE	Gunner Sight	Visual		7.62mm Commander MG	Pitch
		7.62mm Commander MG	Ballistic	A141		Thermal		Primary Turret	Heading
								Secondary Turret	Heading
FR AMX40 MBT	Tracked	120mm Main Gun	Ballistic	APFSDS-T M829A1	Driver Block	Visual	Fuel	120mm Main Gun	Pitch
				HEAT M830	Commander Block	Visual	Ammo	12.7 Coaxial MG	**Pitch
		12.7 Coaxial MG	Ballistic	API	Gunner Sight	Visual		7.62mm Commander MG	Pitch
				API-T		Thermal		Primary Turret	Heading
		7.62mm Commander MG	Ballistic	A141				Secondary Turret	Heading
FR AMX 10 RC 105MM	Wheeled	105mm Main Gun	Ballistic	APFSDS-T M833	Driver Block	Visual	Fuel	105mm Main Gun	Pitch
				HEAT M456A2	Commander Block	Visual	Ammo	7.62mm Coaxial MG	**Pitch
		7.62mm Coaxial MG	Ballistic	A141	Gunner Sight	Visual	DI	Turret	Heading
						Thermal			
FR AMX 10	Tracked	20mm Cannon	Ballistic	AP/HE	Driver Block	Visual	Fuel	20mm Cannon	Pitch
		7.62mm Commander MG	Ballistic	A141	Commander Block	Visual	Ammo	7.62mm Commander MG	Pitch
					Gunner Sight	Visual	DI	Primary Turret	Heading
						Thermal		Secondary Turret	Heading
UK WARRIOR	Tracked	30mm Cannon	Ballistic	APDS	Driver Block	Visual	Fuel	30mm Cannon	Pitch
				HE	Commander Block	Visual	Ammo	7.62mm Coaxial MG	**Pitch
		7.62mm Coaxial MG	Ballistic	A141	Gunner Sight	Visual		Turret	Heading
						Thermal			
GER MARDER	Tracked	20mm Cannon	Ballistic	AP	Driver Block	Visual	Fuel	20mm Cannon	Pitch
				HE	Commander Block	Visual	Ammo	7.62 Coaxial MG	**Pitch
		7.62 Coaxial MG	Ballistic	A141	Gunner Sight	Visual		Turret	Heading
						Thermal			
T62 w/o REACTIVE ARMOR (B variant)	Tracked	115mm Cannon Main Gun	Ballistic	HVAPFSDS	Driver Block	Visual	Fuel	115mm Main Gun	Pitch
				HEAT-FS	Driver Block	I^2	Ammo	7.62mm Coaxial MG	**Pitch
				HE-FRAG	Commander Block	Visual		12.7mm MG	Pitch
		7.62mm Coaxial MG	Ballistic	API		I^2		Primary Turret	Heading
				API-T	Gunner Sight	Visual		Secondary Turret	Heading
		12.7mm Commander MG	Ballistic	API, API-T		I^2			
T64 w/ REACTIVE ARMOR	Tracked	125mm Main Gun	Ballistic	HVAPFSDS	Driver Block	Visual	Fuel	125mm Main Gun	Pitch
				HEAT-FS		I^2	Ammo	7.62mm Coaxial MG	**Pitch
				HE-FRAG				12.7mm MG	Pitch
			Missile	ATGM AT-8	Commander Block	Visual		Primary Turret	Heading
		7.62mm Coaxial MG	Ballistic	API		I^2		Secondary Turret	Heading

				API-T	Gunner Sight	Visual			
		12.7mm MG	Ballistic	API, API-T		I^2			
		Smoke Grenade Launcher	Ballistic	81mm RP Smoke Grenades					
T72 w/o REACTIVE ARMOR	Tracked	125mm Main Gun	Ballistic	HVAPFSDS	Driver Block	Visual	Fuel	125mm Main Gun	Pitch
				HEAT-FS		I^2	Ammo	7.62mm Coaxial MG	**Pitch
				HE-FRAG	Commander Block	Visual		12.7mm MG	Pitch
						I^2		Primary Turret	Heading
		7.62mm Coaxial MG	Ballistic	API	Gunner Sight	Visual		Secondary Turret	Heading
				API-T		I^2			
		12.7mm MG	Ballistic	API, API-T					
		Smoke Grenade Launcher	Ballistic	81mm RP Smoke Grenades					
T72 w/o REACTIVE ARMOR w/ KMT-5m Roller/Plow	Tracked	125mm Main Gun	Ballistic	HVAPFSDS	Driver Block	Visual	Fuel	125mm Main Gun	Pitch
				HEAT-FS		I^2	Ammo	7.62mm Coaxial MG	**Pitch
				HE-FRAG	Commander Block	Visual		12.7mm MG	Pitch
						I^2		Primary Turret	Heading
		7.62mm Coaxial MG	Ballistic	API	Gunner Sight	Visual		Secondary Turret	Heading
				API-T		I^2			
		12.7mm MG	Ballistic	API, API-T					
		Smoke Grenade Launcher	Ballistic	81mm RP Smoke Grenades					
T72 B w/ REACTIVE ARMOR	Tracked	125mm Main Gun	Ballistic	HVAPFSDS	Driver Block	Visual	Fuel	125mm Main Gun	Pitch
				HEAT-FS		I^2	Ammo	7.62mm Coaxial MG	**Pitch
				HE-FRAG	Commander Block	Visual		12.7mm MG	Pitch
			Missile	ATGM AT-11		I^2		Primary Turret	Heading
		7.62mm Coaxial MG	Ballistic	API	Gunner Sight	Visual		Secondary Turret	Heading
				API-T		I^2			
		12.7mm MG	Ballistic	API, API-T					
		Smoke Grenade Launcher	Ballistic	81mm RP Smoke Grenades					
T80 w/o REACTIVE ARMOR	Tracked	125mm Main Gun	Ballistic	HVAPFSDS	Driver Block	Visual	Fuel	125mm Main Gun	Pitch
				HEAT-FS		I^2	Ammo	7.62mm Coaxial MG	**Pitch
				HE-FRAG					
			Missile	ATGM AT-8	Commander Block	Visual		12.7mm MG	Pitch
				ATGM AT-11		I^2		Primary Turret	Heading
		7.62mm Coaxial MG	Ballistic	API	Gunner Sight	Visual		Secondary Turret	Heading
				API-T		Thermal			
		12.7mm MG	Ballistic	API, API-T					
		Smoke Grenade Launcher	Ballistic	81mm RP Smoke Grenades					
T80U w/ REACTIVE ARMOR	Tracked	125mm Main Gun	Ballistic	HVAPFSDS	Driver Block	Visual	Fuel	125mm Main Gun	Pitch
				HEAT-FS		I^2	Ammo	7.62mm Coaxial MG	**Pitch
				HE-FRAG					
			Missile	ATGM AT-8	Commander	Visual		12.7mm MG	Pitch

					Block				
				ATGM AT-11		I^2		Primary Turret	Heading
		7.62mm Coaxial MG	Ballistic	API	Gunner Sight	Visual		Secondary Turret	Heading
				API-T		Thermal			
		12.7mm MG	Ballistic	API, API-T					
		Smoke Grenade Launcher	Ballistic	81mm RP Smoke Grenades					
BMP 1P	Tracked	73mm Main Gun	Ballistic	MP	Driver Block	Visual	Fuel	73mm Main Gun	Pitch
				HEAT-FS		I^2	Ammo	7.62mm Coaxial MG	**Pitch
				FRAG-HE	Commander Block	Visual	DI	AT-5	** Pitch
		7.62mm Coaxial MG	Ballistic	API		I^2		Primary Turret	Heading
				API-T	Gunner Sight	Visual			
		AT-5	Missile	SPANDREL Missile		I^2			
BMP II	Tracked	30mm Main Gun	Ballistic	APT	Driver Block	Visual	Fuel	30mm Main Gun	Pitch
				HEI		I^2	Ammo	7.62mm Coaxial MG	** Pitch
		7.62mm Coaxial MG	Ballistic	API	Commander Block	Visual	DI	AT-5	** Pitch
				API-T		I^2		Turret	Heading
					Gunner Sight	Visual			
		AT-5	Missile	SPANDREL Missile		I^2			
		Smoke Grenade Launcher	Ballistic	81mm RP Smoke Grenades					
BMP III, 100MM, 30MM & AT10	Tracked	100mm Main Gun	Ballistic	HEAT-FS	Driver Block	Visual	Fuel	100mm Main Gun	Pitch
				FRAG-HE		I^2	Ammo	30mm Cannon	Pitch
			Missile	AT-10	Gunner Sight	Visual		7.62 Coaxial MG	**Pitch
		Smoke Grenade Launcher	Ballistic	81mm RP Smoke Grenades				Turret	Heading
		30mm Cannon	Ballistic	AP-T		I^2			
					Commander Block	Visual			
				HEI		I^2			
BRDM 2	Wheeled	14.5mm MG	Ballistic	14.5mm MG ammo	Driver Block	Visual	Fuel	14.5mm MG	Pitch
		7.62mm Coaxial MG	Ballistic	API		I^2	Ammo	7.62mm Coaxial MG	**Pitch
				API-T	Co-Driver Block	Visual	DI	Turret	Heading
				Ball		I^2			
					Gunner Sight	Visual			
						I^2			
					Commander Block	Visual			
						I^2			
BRDM 2 w/ AT-5	Wheeled	AT-5	Missile	SPANDREL	Driver Block	Visual	Fuel	AT-5	Pitch
						I^2	Ammo	Turret	Heading
					Co-Driver Block	Visual	DI		
						I^2			
					Gunner Sight	Visual			
						I^2			
					Commander Block	Visual			
						I^2			
1V12 MT-LB (ACRV)	Tracked	12.7mm Commander MG	Ballistic	API	Driver Block	Visual	Fuel	12.7mm Commander MG	Pitch

				API-T	Commander Block	Visual	Ammo	Turret	Heading
							DI		
BMP 1KSH , CMD & COM VEH	Tracked	N/A	N/A	N/A	Driver Block	Visual	Fuel	N/A	N/A
						I^2	Ammo	N/A	
					Commander Block	Visual	DI		
						I^2			
BTR 60P	Wheeled	14.5mm MG	Ballistic	14.5mm MG ammo	Driver Block	Visual	Fuel	14.5mm MG	Pitch
		7.62mm Coaxial MG	Ballistic	API		I^2	Ammo	7.62mm Coaxial MG	**Pitch
				API-T	Commander Block	Visual	DI	Turret	Heading
						I^2			
					Gunner Sight	Visual			
BTR 80, 14.5MM, 7.62 MG	Wheeled	14.5mm MG	Ballistic	14.5mm MG ammo	Driver Block	Visual	Fuel	14.5mm MG	Pitch
		7.62mm Coaxial MG	Ballistic	API		I^2	Ammo	7.62mm Coaxial MG	**Pitch
				API-T	Commander Block	Visual	DI	Turret	Heading
		Smoke Grenade Launcher	Ballistic	81mm RP Smoke Grenades		I^2			
					Gunner Sight	Visual			
BAT-2 Route Clearing Vehicle	Tracked	N/A	N/A	N/A	Driver Block	Visual	Fuel	N/A	N/A
2S12 MORTAR	Wheeled	120mm Mortar Launcher	Ballistic	HE-FRAG	N/A		Ammo	120mm Mortar Launcher	Pitch
				Illum					
				Incen/Smoke					
D30 122MM TOWED HOW	Wheeled	122mm Gun	Ballistic	HE-FRAG	N/A		Ammo	122mm Gun	Pitch
				Illum				Turret	Heading
				FLECHETT E					
MT12, 100MM AT GUN	Wheeled	100MM Gun	Ballistic	FRAG-HE	N/A		Ammo	100MM Gun	Pitch
				HEAT-FS					
				HVAPFSDS					
			Missile	AT-10					
2S23 COMB GUN on BTR-80	Wheeled	120mm Main Gun	Ballistic	FRAG-HE	Driver Block	Visual	Fuel	120mm Main Gun	Pitch
				HEAT-FS		I^2	Ammo	7.62mm Coaxial MG	** Pitch
				WP	Commander Block	Visual		Turret	Heading
				Illum		I^2			
				Incend	Gunner Sight	Visual			
		7.62mm Coaxial MG	Ballistic	API		I^2			
				API-T					
2S31 COMBINATION GUN on BMP	Tracked	120mm Main Gun	Ballistic	WP	Driver Block	Visual	Fuel	120mm Main Gun	Pitch
				HEAT-FS		I^2	Ammo	7.62mm Coaxial MG	** Pitch
				FRAG-HE	Commander Block	Visual		Turret	Heading
				Incend		I^2			
				Illum	Gunner Sight	Visual			
		7.62mm Coaxial MG	Ballistic	API		I^2			
				API-T					
2S1, 122MM SP HOWITZER	Tracked	122mm Cannon	Ballistic	FRAG-HE	Driver Block	Visual	Fuel	122mm Howitzer	Pitch
				HEAT-FS		I^2	Ammo	Turret	Heading

				Illum	Commander Block	Visual			
				Incen		I^2			
				Flechette	Gunner Sight	Visual			
2S3, 152MM SP HOWITZER	Tracked	152mm Cannon	Ballistic	HE, PD	Driver Block	Visual	Fuel	152mm SP Howitzer	Pitch
				HE, VT		I^2	Ammo	Turret	Heading
					Commander Block	Visual			
						I^2			
					Gunner Sight	Visual			
2S19, 152MM SP HOWITZER	Tracked	152mm Cannon	Ballistic	HE, PD	Driver Block	Visual	Fuel	152mm SP Howitzer	Pitch
				HE, VT		I^2	Ammo	Turret	Heading
					Commander Block	Visual			
						I^2			
					Gunner Sight	Visual			
SA15 AD MISSILE ARTILLERY	Tracked	SA-15 Missile Launcher	Missile	SA-15	Driver Block	Visual	Fuel	SA-15 Missile Launcher (azimuth only)	Heading
						I^2	Ammo		
					Commander Blcok	RADAR	Ammo		
SA13 AD MISSILE ARTILLERY	Tracked	SA-13 Missile Laucher	Missile	SA-13	Driver Block	Visual	Fuel	SA-13 Missile Laucher	Pitch
						I^2	Ammo	Turret	Heading
					Commander Block	RADAR			
2S6, QUAD 30MM; SA19	Tracked	30mm Cannons	Ballistic	AP-T	Driver Block	Visual	Fuel	30mm Cannons	Pitch
				HE		I^2	Ammo	SA-19 Missile Launcher	Pitch
		SA-19 Missile Launcher	Missile	SA-19	Commander Block	RADAR		Turret	Heading
KMT-5M ROLLER/PLOW	Attached	N/A	N/A	N/A	Driver Block	Visual	N/A	N/A	N/A
MTU-20 AVLB	Tracked	N/A	N/A	N/A	Driver Block	Visual	Fuel	Bridge	Pitch, Y, Z
					Commander Block	Visual		Bridge Front	Pitch
								Bridge Back	Pitch
ZSU 23-4, Quad 23mm	Tracked	Quad 23mm Cannons	Ballistic	HEI	Driver Block	Visual	Fuel	Quad 23mm Cannons	Pitch
				API-T	Commander Block	Visual	Ammo	Turret	Heading
				HEI-T					
GAZ-66 TRK	Wheeled	N/A	N/A	N/A	Driver Block	Visual	Fuel	N/A	N/A
							Ammo		
							Cargo		
UAZ-469 TRK	Wheeled	N/A	N/A	N/A	Driver Block	Visual	Fuel	N/A	N/A
							DI		
GMZ TRACKED MINE LAYER	Tracked	Mine Layer	Ballistic	Mine, Anti-Personnel	Driver Block	Visual	Fuel	N/A	N/A
				Mine, Anti-Tank	Commander Block	Visual	Ammo		
BREM1 RECOVERY VEH	Tracked	7.62mm MG	Ballistic	API	Driver Block	Visual	Fuel	7.62mm MG	Pitch/ Heading
				API-T		I^2	Ammo		
					Commander Block	Visual			
						I^2			
KRAZ 255B TRUCK	Wheeled	N/A	N/A	N/A	Driver Block	Visual	Fuel	N/A	N/A
							Cargo		
KRAZ 255B TRUCK FS	Wheeled	N/A	N/A	N/A	Driver Block	Visual	Fuel	N/A	N/A

							Cargo (Fuel only)		
DI ENG ELEMENT 10 PERS (All mbrs.)	DI	N/A	N/A	N/A	DI Block	Visual	N/A	N/A	N/A
DI INF MEMBERS 1, 2 , 3 & 4	DI	AK-74 Rifle	Ballistic	5.45mm Ball Tracer	DI Block	Visual	Ammo	AK-74 Rifle	Pitch/ Heading
				5.45mm Linked Tracer		I^2			
DI INF MEMBER 5	DI	RPK-74	Ballistic	5.45mm Ball Tracer	DI Block	Visual	Ammo	RPK-74	Pitch/ Heading
				5.45mm Linked Tracer		I^2			
DI INF MEMBER 6	DI	RPG-7V	Ballistic	HEAT	DI Block	Visual	Ammo	RPG-7V	Pitch/ Heading
						I^2			
DI SCOUTS MEMBER 1, 2 & 3	DI	AK-74 Rifle	Ballistic	5.45 Ball Tracer	DI Block	Visual	Ammo	AK-74 Rifle	Pitch/ Heading
						I^2			
DI ATGM TM (AT-7) MEMBER 1	DI	AT-7 SAXHORN	Missile	HEAT	DI Block	Visual	Ammo	AT-7 SAXHORN	Pitch/ Heading
						I^2			
DI ATGM TM (AT-7) MEMBER 2	DI	AK-74 Rifle	Ballistic	5.45mm Ball Tracer	DI Block	Visual	Ammo	AK-74 Rifle	Pitch/Heading
						I^2			
DI ATGM TM (AT-4) MEMBER 1	DI	AT-4	Missile	SPIGOT Missile	DI Block	Visual	Ammo	AT-4	Pitch/ Heading
						I^2			
DI ATGM TM (AT-4) MEMBER 2 & 3	DI	AK-74 Rifle	Ballistic	5.45mm Ball Tracer	DI Block	Visual	Ammo	AK-74 Rifle	Pitch/ Heading
						I^2			
DI AGL TM MEMBER 1	DI	AK-74 Rifle	Ballistic	5.45 Ball Tracer	DI Block	Visual	Ammo	AK-74 Rifle	Pitch/ Heading
		AGL-17	Ballistic	30mm HE-FRAG		I^2			
DI AGL TM MEMBER 2	DI	AK-74 Rifle	Ballistic	5.45 Ball Tracer	DI Block	Visual	Ammo	AK-74 Rifle	Pitch/ Heading
						I^2			
DI SA16/18 TEAM MEMBER 1, Configuration #1	DI	SA-16	Missile	HE	DI Block	Visual	Ammo	SA-16	Pitch/Heading
						I^2			
DI SA16/18 TEAM MEMBER 1 Configuration #2	DI	SA-18	Missile	HE	DI Block	Visual	Ammo	SA-18	Pitch/ Heading
						I^2			
DI SA16/18 TEAM MEMBER 2	DI	AK-74 Rifle	Ballistic	5.45mm Ball Tracer	DI Block	Visual	Ammo	AK-74 Rifle	Pitch/ Heading
						I^2			
MI-8T/ HIP C	RWA	12.7mm MG	Ballistic	API-T	Driver (Pilot) Block	Visual	Fuel	N/A	N/A
							Ammo		
							DI		
MI-24P HIND	RWA	AT-6 ATGM Launcher Tubes	Missile	AT-6	Driver (Pilot) Block	Visual	Fuel	30mm Auto Cannon	Pitch/ Heading
		30mm Auto Cannon	Ballistic	AP			Ammo		
				HE					
MI-28 HAVOC	RWA	AT-6 ATGM Launcher Tubes	Missile	AT-6	Driver (Pilot) Block	Visual	Fuel	30mm Auto Cannon	Pitch/ Heading
		30mm Auto Cannon	Ballistic	AP, HE			Ammo		
KA-50 HOKUM	RWA	AT-6 ATGM Launcher Tubes	Missile	AT-6	Driver (Pilot) Block	Visual	Fuel	30mm Auto Cannon	Pitch/ Heading
		30mm Auto Cannon	Ballistic	AP, HE			Ammo		

SU-25 FROGFOOT	FWA	Bomb, General Purpose	Ballistic	General Purpose Bomb	Driver (Pilot) Block	Visual	Fuel	N/A	N/A
		Bomb, Cluster unit	Ballistic	Cluster Bomb			Ammo		
		Bomb, Laser Guided	Guided Bomb	Laser Guided Bomb					
		30mm Auto Cannon	Ballistic	HE/AD					
SU-24 FENCER	FWA	Bomb, General Purpose	Ballistic	General Purpose Bomb	Driver (Pilot) Block	Visual	Fuel	N/A	N/A
		Bomb, Cluster unit	Ballistic	Cluster Bomb			Ammo		
		Bomb, Laser Guided	Guided Bomb	Laser Guided Bomb					
		23mm Cannon	Ballistic	HE, AP					
MIG 27 FLOGGER	FWA	Bomb, General Purpose	Ballistic	General Purpose Bomb	Driver (Pilot) Block	Visual	Fuel	N/A	N/A
		Bomb, Cluster unit	Ballistic	Cluster Bomb			Ammo		
		Bomb, Laser Guided	Guided Bomb	Laser Guided Bomb					
		23mm Cannon	Ballistic	HE, AP, HE-FRAG					
SU-17 FITTER	FWA	Bomb, General Purpose	Ballistic	General Purpose Bomb	Driver (Pilot) Block	Visual	Fuel	N/A	N/A
		Bomb, Cluster unit	Ballistic	Cluster Bomb			Ammo		
		Bomb, Laser Guided	Guided Bomb	Laser Guided Bomb					
		(2) 30mm Auto Cannon	Ballistic	HE/AD					
M577A2	Tracked	N/A	N/A	N/A	Driver Block	Visual	Fuel	N/A	N/A
						I2 (NVG)			
					Commander Block	Visual			
						I2 (NVG)			
M978 HEMTT (FUEL)	Wheeled	N/A	N/A	N/A	Driver Block	Visual	Fuel	N/A	N/A
						I2 (NVG)	Cargo		
M977 HEMTT (CARGO)	Wheeled	N/A	N/A	N/A	Driver Block	Visual	Fuel	N/A	N/A
						I2 (NVG)	Cargo		
M985 HEMTT (CARGO)	Wheeled	N/A	N/A	N/A	Driver Block	Visual	Fuel	N/A	N/A
						I2 (NVG)	Cargo		
M1091 MTV - 5 TON POL TANKER	Wheeled	N/A	N/A	N/A	Driver Block	Visual	Fuel	N/A	N/A
						I2 (NVG)	Cargo		
AMMO PRESTOCK	N/A	N/A	N/A	N/A	N/A	N/A	Cargo	N/A	N/A
FUEL PRESTOCK	N/A	N/A	N/A	N/A	N/A	N/A	Cargo	N/A	
M1078 LMTV - 2.5 TON TRUCK	Wheeled	N/A	N/A	N/A	Driver Block	Visual	Fuel	N/A	N/A
						I2 (NVG)			
M1079 LMTV VAN	Wheeled	N/A	N/A	N/A	Driver Block	Visual	Fuel	N/A	N/A
						I2 (NVG)			
M1083 MTV - 5 TON TRUCK	Wheeled	N/A	N/A	N/A	Driver Block	Visual	Fuel	N/A	N/A

						I2 (NVG)			
M984E1 HEMTT WRECKER	Wheeled	N/A	N/A	N/A	Driver Block	Visual	Fuel	N/A	N/A
						I2 (NVG)			
M88A2 RECOVERY VEHICLE	Tracked	N/A	N/A	N/A	Driver Block	Visual	Fuel	N/A	N/A
						I2 (NVG)			
					Commander Block	Visual			
						I2 (NVG)			
M1089 MTV WRECKER	Wheeled	N/A	N/A	N/A	Driver Block	Visual	Fuel	N/A	N/A
						I2 (NVG)			
M992 FAASV	Tracked	N/A	N/A	N/A	Driver Block	Visual	Fuel	N/A	N/A
					Commander Block	Visual	Cargo		
M728 CEV	Tracked	Demolition Gun	Ballistic	165 HEP	Driver Block	Visual	Fuel	165mm Demolition Gun	Pitch
						I2 (NVG)	Ammo	Turret	Heading
					Commander Block	Visual			
						I2 (NVG)			
					Loader Block	Visual			
					Gunner Sight	Visual			
						I2			
LNCHR AVLB M60A1	Tracked	N/A	N/A	N/A	Driver Block	Visual	Fuel	Bridge, 60 AVLB Launched	Pitch
						I2 (NVG)		Bridge Upper	Pitch
					Commander Block	Visual		Bridge Lower	Pitch
						I2 (NVG)			
M9ACE	Tracked	N/A	N/A	N/A	Driver Block	Visual	Fuel	N/A	N/A
						I2 (NVG)			
M58 A3 MCLIC	Towed	Line Charge	Cluster of C4	C-4 Composition B	N/A	N/A		N/A	N/A
US DSMNT ENGINEER PERSONNEL (1 - 8 PERSON TEAM)	DI	N/A	N/A	N/A	DI Block	Visual	Fuel	N/A	N/A
						I2 (NVG)			
M1083 W/ VOLCANO	Wheeled	Volcano Launching Pods	Ballistic	M16 and M21 Mine Mix	Driver Block	Visual	Ammo	N/A	N/A
						I2 (NVG)	Fuel		
M1064 MORTAR CARRIER	Tracked	120mm Main Mortar	Ballistic	M68, Smoke (WP) w/ PD M935 Fuze	Driver Block	Visual	Fuel	120mm Main Mortar	Heading
				M57, HE (Frag) w/ PD M935 Fuze		I2 (NVG)	Ammo		
				M933, HE (Frag) w/ PD M745 Fuze	Commander Block	Visual			
				M934, HE (Frag) w/ M934 Multioption Fuze (PD, Proximity, or Delayed)		I2 (NVG)			
				M929, Smoke (WP) w/ PD M745 Fuze					

				M91, Illum s/ MT M776 Fuze					
				M930, Illum w/ MT M776 Fuze					
M109A5 HOWITZER	Tracked	155 mm Main Gun	Ballistic	HC / M825WP	Driver Block	Visual	Fuel	155mm Main Gun	Pitch
				M712 LGM COPPERHE AD		Thermal	Ammo		
				M107 Ser HE, MT, PD, & VT	Commander Block	Visual		Turret	Heading
				M449 Ser APICM	Gunner Sight	Visual			
				M485A2 Illum					
				M483A1 DPICM					
				M731 , FASCAM ADAM					
				M741, FASCAM RAAMS					
DI MANNED MODULE	DI	M60	Ballistic	7.62mm					
		M18A1	Claymore Mine						N/A
M109A6 HOWITZER	Tracked	155mm Main Gun	Ballistic	HC / M825WP	Driver Block	Visual	Fuel	155mm Main Gun	Pitch
						Thermal	Ammo	Turret	Heading
					Commander Block	Visual			
					Gunner Sight	Visual			
				M712 LGM COPPERHE AD					
				M107 Ser HE, MT, PD, & VT					
				M449 Ser APICM					
				M485A2 Illum					
				M483A1 DPICM					
				M731 , FASCAM ADAM					
				M741, FASCAM RAAMS					
M270 MLRS	Tracked	270mm Rocket Pods	Rocket	M26 Tact 270mm Rocket w/AT2 Warhead	Driver Block	Visual	Ammo	Launch Platform	Pitch
			Rocket	M26 Tact 270mm Rocket w/M77 Warhead		Thermal	Fuel	Turret	Heading
			Rocket	M26 Tact 270mm Rocket w/TGW Warhead					
A10 WARTHOG AIRCRAFT	FWA	General Purpose Bomb	Ballistic	MK82 LD (Slick)	Driver (Pilot) Block	Visual	Fuel	N/A	
				MK82 Air (Air inflatable retarder)		I^2 (NVG)	Ammo		
				MK82 HD					

				(High Drag)					
				MK84 LD (Slick)					
				MK84 Air (Air inflatable retarder)					
				BLU-109/B					
		Laser Guided Bombs	Ballistic	GBU-10 (MK84 LGB), slick					
				GBU-12 (MK82 LGB), slick					
		Cluster Bomb Units	Ballistic	CBU52B/B (delivers 220 BLU-61A/B bomblets)					
				CBU58A/B (delivers 650 BLU-63A/B bomblets)					
				CBU71A/B (delivers 650 BLU-86A/B bomblets w/ random fuze)					
				CBU87 (delivers 202 BLU-97 bomblets)					
				CBU89/B (delivers 72 BLU-91/B AT and 22 BLU-92/B AP mines)					
		GAU-8 Avenger 30mm Cannon	Ballistic	30 mm API					
		Laser Guided Missile	Missile	AGM-65 Maverick					
F16 FALCON AIRCRAFT	FWA	General Purpose Bomb	Ballistic	MK82 LD (Slick)	Driver (Pilot) Block	Visual	Fuel	N/A	
				MK82 Air (Air inflatable retarder)			Ammo		
				MK82 HD (High Drag)					
				MK84 LD (Slick)					
				MK84 Air (Air inflatable retarder)					
		Laser Guided Bombs	Ballistic	GBU-10 (MK84 LGB), slick					
				GBU-12 (MK82 LGB), slick					
		Cluster Bomb Units	Ballistic	CBU52B/B (delivers 220 BLU-61A/B bomblets)					
				CBU58A/B (delivers 650 BLU-63A/B bomblets)					
				CBU71A/B (delivers 650 BLU-86A/B bomblets w/ random fuze)					
				CBU87 (delivers 202 BLU-97 bomblets)					
				CBU89/B (delivers 72 BLU-91/B AT and 22 BLU-92/B AP mines)					

		Concrete Penetraton Bomb	Ballistic	BLU-107 DURANDAL					
		GPU-5A 30mm Cannon	Ballistic	30 mm API					
		Laser Guided Missile	Missile	AGM-65 Maverick					

** Linked to main gun.
NOTE: All coaxial weapons are linked to the main gun for pitch, however, it does maintain its own pitch based on the main gun.

Table A-II. General Use Models					
Platforms	**Type**	**Category**	**DMGD 1**	**DMGD 2**	**Notes**
US Vehicle/Equip Models					
Bridge, 60 AVLB Launched	3D	Moveable	Yes		
LNCHR AVLB M60A1 Series	3D	CBT Vehicle	Yes		
M1A1, 120mm	3D	CBT Vehicle	Turret	Hull	
M1A2, 120mm	3D	CBT Vehicle	Turret	Hull	
M1043 HMMWV ARMT CARR w/MK 19	3D	CBT Vehicle	Turret	Hull	
M1044 HMMWV ARMT CARR w/M2 (.50 cal)	3D	CBT Vehicle	Turret	Hull	
M1064, CARR Mort W BMS 120	3D	CBT Vehicle	Yes		
M113A3, CARR Pers	3D	CBT Vehicle	Yes		
M2A2/M3A2/BSFV/IVF/CFV, 25mm & TOW	3D	CBT Vehicle	Turret	Hull	
M577A2 Carr CP (With and w/o tent ext.)	3D	CBT Vehicle	Yes		
M58 A3 MCLIC	3D	CBT Vehicle	Turret	Hull	
M728 CEV	3D	CBT Vehicle	Turret	Hull	
M9 ACE	3D	CBT Vehicle	Yes		
M93 NBC Recon Vehicle	3D	CBT Vehicle	Yes		No NBC tasks
M981 FISTV	3D	CBT Vehicle	Turret	Hull	
M992 FAASV	3D	TAC Vehicle	Yes		
M998, HMMWV (Stinger Tms, 1SG, UMCP)	3D	CBT Vehicle	Yes		

Table A-II. General Use Models					
Mine Plows (back of HEMTT for transport)	3D	CBT Vehicle	Yes		
Mine Plows (on M1A1 Tank)	3D	CBT Vehicle	Yes		
Mine Rollers (back of HEMTT for Transport)	3D	CBT Vehicle	Yes		
Mine Rollers (on M1A1 Tank)	3D	CBT Vehicle	Yes		
M1025 HMMWV w/M2 (.50 cal)	3D	TAC Vehicle	Yes		
M1078 LMTV (2.5T)	3D	TAC Vehicle	Yes		
M1079 LMTV Van	3D	TAC Vehicle	Yes		
M1083 MTV (5T)	3D	TAC Vehicle	Yes		
M1089 MTV Wrecker	3D	TAC Vehicle	Yes		
M109A5 SP HOW	3D	CBT Vehicle	Turret	Hull	
M109A6 SP HOW	3D	CBT Vehicle	Turret	Hull	Model
M1091 MTV (5T) POL Tanker	3D	TAC Vehicle	Yes		
M270 MLRS	3D	CBT Vehicle	Turret	Hull	
M88 A2 Recvy Veh.	3D	CBT Vehicle	Yes		
M966 TRK Util HMMWV w/TOW	3D	CBT Vehicle	Turret	Hull	
M977 HEMTT, Cargo	3D	TAC Vehicle	Yes		
M978, HEMTT, FS	3D	TAC Vehicle	Yes		
M984 A1, HEMTT Wrecker	3D	TAC Vehicle	Yes		
M985 HEMTT, Cargo	3D	TAC Vehicle	Yes		
M1 Tank, 105mm	3D	CBT Vehicle	Turret	Hull	
M113	3D	CBT Vehicle	Yes		

Table A-II. General Use Models					
VOLCANO (mounted on an M1083)	3D	TAC Vehicle	M1083 only		
US Personnel Models					
US ATGM, 2 Pers, JAVELIN, DRAGON & M16	3D	Personnel	Attrited		Use Javelin Visual model for Dragon
US DSMT ENGR Pers, 8 Pers	3D	Personnel	Attrited		
US INF Fire Team, 4 Pers	3D	Personnel	Attrited		
US Scouts, 2 pers, SAW and COMMO	3D	Personnel	Attrited		
US Stinger TM, 2 Pers	3D	Personnel	Attrited		
US Inf, 1 Pers, Weapons (DIM only)	3D	Personnel	Attrited		Non-SAF
US Rotary Wing Models					
AH1S Cobra	3D	Attack	Yes		
AH64 Apache	3D	Attack	Yes		
OH 58D	3D	Scout	Yes		
UH60A Blackhawk	3D	Utility	Yes		
US Fixed Wing					
A10 Warthog	3D	Combat	Yes		
F16 Falcon	3D	Combat	Yes		
OPFOR Combat Vehicles					
ACRV, 1V12	3D	CBT Vehicle	Yes		
2S1, 122mm SP Howitzer	3D	CBT Vehicle	Turret	Hull	
2S19, 152mm SP Howitzer	3D	CBT Vehicle	Turret	Hull	

Table A-II. General Use Models					
2S3, 152mm SP Howitzer	3D	CBT Vehicle	Turret	Hull	
2S31, Combination Gun mtd in BMP	3D	CBT Vehicle	Turret	Hull	
2S6, Quad 30mm, 8 SA 19	3D	CBT Vehicle	Turret	Hull	
BRDM 2, ATGM, w/5 AT5 (9P148)	3D	CBT Vehicle	Yes		
BMP II, 30mm & AT5	3D	CBT Vehicle	Turret	Hull	
BMP IKsh, Cmd & Comm Veh	3D	CBT Vehicle	Yes		
BMP IP, 73 mm & AT5	3D	CBT Vehicle	Turret	Hull	
BRDM 2, RECON, 14.5mm & 7.62mm MG	3D	CBT Vehicle	Turret	Hull	
GMZ Tracked Mine Layer	3D	TAC Vehicle	Yes		
MTU-20 AVLB	3D	CBT Vehicle	Yes		
Bridge, MTU-20 AVLB	3D	Moveable	Yes		
KMT-5M Roller/Plow, mounted on an OPFOR tank	3D	CBT Vehicle	Yes		
MT12	3D	CBT Vehicle	Yes		
SA-13, AD Missile Artillery	3D	CBT Vehicle	Yes		
T72B w/Reactive AR	3D	CBT Vehicle	Turret	Hull	
T72 w/o Reactive AR	3D	CBT Vehicle	Turret	Hull	
T80U w/Reactive AR	3D	CBT Vehicle	Turret	Hull	
2S23, Combination Gun mtd in BTR 80	3D	CBT Vehicle	Turret	Hull	
BMP III, 100mm, 30mm, & AT-10	3D	CBT Vehicle	Turret	Hull	
BTR 60P, 14.5mm	3D	CBT Vehicle	Turret	Hull	
BTR 80, 14.5mm	3D	CBT Vehicle	Turret	Hull	

Table A-II. General Use Models

D30, 122mm Howitzer, Towed	3D	CBT Vehicle	Yes		
SA-15, AD Missile Artillery, 2S6 Chassis	3D	CBT Vehicle	Yes		
T62 w/o Reactive AR	3D	CBT Vehicle	Turret	Hull	
T64/T64B both w/Reactive AR	3D	CBT Vehicle	Turret	Hull	
T80 w/o Reactive AR	3D	CBT Vehicle	Turret	Hull	
ZSU 23-4, Quad 23mm	3D	CBT Vehicle	Turret	Hull	
2S12 120mm Mortar	3D	Mortar	Yes		
BREM1 Recovery Vehicle	3D	TAC Vehicle	Yes		
Trk, GAZ-66 (Cargo, Medium)	3D	TAC Vehicle	Yes		
Trk, UAZ 469 (Cargo, Light/Personnel)	3D	TAC Vehicle	Yes		
Trk, KrAZ-255B (Fuel Service)	3D	TAC Vehicle	Yes		
Trk, KrAZ-255B (Cargo, Heavy)	3D	TAC Vehicle	Yes		
BAT-2 Route Clearing Vehicle	3D	CBT Vehicle	Yes		
OPFOR Dismounted Forces					
OPFOR AGL Team, 2 Pers	3D	Personnel	Attrited		
OPFOR ATGM Team, 2 Pers	3D	Personnel	Attrited		
OPFOR ATGM Team, 3 Pers	3D	Personnel	Attrited		
OPFOR Dismt Eng Element, 10 Pers	3D	Personnel	Attrited		
OPFOR Dismt Inf Ele, 6 Pers RPG-7V	3D	Personnel	Attrited		
OPFOR Dismt Scouts, 3 Pers, Wpn	3D	Personnel	Attrited		
OPFOR SA 16/18 Dismt Inf AD Weapon, 2 Pers	3D	Personnel	Attrited		

Table A-II. General Use Models					
OPFOR Rotary Wing					
MI-24P Hind	3D	Attack	Yes		
MI-28 Havoc A	3D	Attack	Yes		
MI-8T Hip	3D	Assault	Yes		
KA-50 Hokum A	3D	Attack	Yes		
OPFOR Fixed Wing					
SU25 Frogfoot	3D	Combat	Yes		
MIG27 Flogger	3D	Combat	Yes		
SU17 Fitter	3D	Combat	Yes		
SU24 Fencer	3D	Combat	Yes		
Misc. Combat Vehicles					
British Challenger, 120mm	3D	CBT Vehicle	Turret	Hull	
British Chieftan, 120mm	3D	CBT Vehicle	Turret	Hull	
French AMX 10 ARC, 105mm	3D	CBT Vehicle	Turret	Hull	
French AMX 10P	3D	CBT Vehicle	Turret	Hull	
French AMX 30 MBT, 105mm	3D	CBT Vehicle	Turret	Hull	
French AMX 40 LeClerc MBT, 120mm	3D	CBT Vehicle	Turret	Hull	
German LEO IA4 MBT, 105mm	3D	CBT Vehicle	Turret	Hull	
German LEO II MBT, 120mm	3D	CBT Vehicle	Turret	Hull	
Marder 2 (GE)	3D	CBT Vehicle	Turret	Hull	
Warrior (UK)	3D	CBT Vehicle	Yes		

Table A-II. General Use Models

Obstacles/Positions

Abatis, 8 tree	2D	Obstacle	Yes		
Building, Indirect Fire Damage	2D	Rubbled Bldg	Yes		
Covered Machine Gun Bunker	2D	Prepared Position	Yes		
Fence, Concertina, 3 Roll	3D	Obstacle	Yes		
Combined/Hull Defilade Position, Armored Vehicle	2D	Prepared Position	Yes		
Combined/Hull Defilade Position, Fighting Vehicle	2D	Prepared Position	Yes		
Combined/Hull Defilade Position, Mort Carrier	2D	Prepared Position	Yes		
Combined/Hull Defilade Position, Tank	2D	Prepared Position	Yes		
Infantry Fighting Position	2D	Prepared Position	Yes		
Log Crib, Rectangle	3D	Obstacle	Yes		
Machine Gun Prepared Position	2D	Prepared Position	Yes		
Minefield, Hasty, 0-300 meters	2D	Obstacle	No		No Visual model
Minefield, Prepared, 0-500 meters	2D	Obstacle	No		No Visual model
Minefield, Scatterable, Oval	2D	Obstacle	No		No Visual model
Overhead Covered Infantry Position	2D	Prepared Position	Yes		
Prestock Entity (Ammo)	2D	Obstacle	Yes		
Prestock Entity (Fuel)	2D	Obstacle	Yes		
Tank Ditch, 100 x 4 meters	2D	Obstacle	Yes		
Tank Ditch, 200 x 4 meters	2D	Obstacle	Yes		

Table A-II. General Use Models

Tank Ditch, 300 x 4 meters	2D	Obstacle	Yes		
Cleared Mine Lane Markers	2D	Obstacle	No		
Bridge, Ribbon, 14 Sections	2D	Bridge	No		Variable size in increments of sections

Table A-III. General Use Models

Ammunition Effects	Platforms
40mm Grenade (M430 linked grenades)	M1043 w/MK-19; M1025 w/MK-19
40mm Grenade (M433 single grenades)	M203 Grenade Launcher (BLUFOR DI); M113A3 and M2A2/M3A2 (BLUFOR DI)
.50 Caliber Machine Gun (A534 API-T)	M1025; M1A1; M1A2; M1044 w/M2; M113A3; AMX40
100mm HEAT-FS, FRAG-HE, HVAPFSDS-T	MT-12; BMP III
105mm APFSDS-T (M833)	M1; LEO 1A4 MBT; AMX 10; AMX30
105mm HEAT-T (M456A2)	M1; LEO 1A4 MBT; AMX 10; AMX30
115mm HVAPFSDS, HEAT-FS, HE FRAG	T-62
12.7mm API, API-T Machine Gun	1V12; T-62; T-64; T-72; T-80; MI-8T
120mm APFSDS-T (M829)	M1A1; M1A2; Challenger; Chieftain; AMX40; LEO II
120mm HEAT-MP-T (M830)	M1A1; M1A2; Challenger; Chieftain; AMX40; LEO II
120mm Mortar Ammo, Fuzed Smoke (WP) (M68), FRAG-HE (M57, M933, M934), Illum (M91)	M1064
120mm Mortar, FRAG-HE, Smoke, Illum, Incen	2S12(SP)
120mm/Gun/Mortar FRAG-HE, HEAT-FS, WP, Illum, Incen	2S23; 2S31
122mm FRAG-HE, HEAT-FS, Illum, Flechette	D30; 2S1
125mm HVAPFSDS, HEAT-FS, HE FRAG	T-64; T-72; T-80
14.5mm Machine Gun	BRDM 2 Recon; BTR60; BTR80
152mm Howitzer, HE (PD & VT)	2S3; 2S19
155mm Howitzer, M825WP/Smoke (MT)	M109A5; M109A6
155mm Howitzer, M712 LGM Copperhead (BD)	M109A5; M109A6
155mm Howitzer, M107 Ser HE (MT, PD & VT)	M109A5; M109A6

Table A-III. General Use Models	
155mm Howitzer, M449A1 APICM (MT)	M109A5; M109A6
155mm Howitzer, M485A2 Illum (MT)	M109A5; M109A6
155mm Howitzer, M483A1, DPICM (MT)	M109A5; M109A6
155mm Howitzer, M731, FASCAM ADAM (MT)	M109A5; M109A6
155mm Howitzer, M741, FASCAM RAAMS (MT)	M109A5; M109A6
165mm HEP	M728 CEV
2.75 inch Rockets (M261)	AH-64; AH1S Cobra
20mm Auto Cannon, AP & HE	AH1S Cobra; Marder 2; AMX10P; AMX30
23mm HEI, HEI-T, API-T	ZSU 23-4; SU 24; MIG-27
25mm Ammo, APFSDS-T (M919)	M2A2; M3A2
25mm Ammo, HE I-T (M792)	M2A2; M3A2
30mm AP-T HEI, FRAG HE Grenade (low velocity)	AH-64
30mm AP-T FRAG HE Grenade (low velocity)	AGL-17 (OPFOR DI)
30mm Auto Cannon AP-T & HE (high velocity)	MI-24; MI-28; KA-50; SU-25; SU-17; 2S6; BMP-II; BMP-III; Warrior
5.45mm Ball, Tracer	AK74 Rifle (OPFOR DI)
5.45mm Ball & linked Tracer	RPK-74 (OPFOR DI)
5.56mm ball & linked Tracer (A064)	M1025 w/M249; M249 SAW (BLUFOR DI); M113A3 and M2A2/M3A2 (BLUFOR DI)
5.56mm ball (M855), Tracer (M856)	M16A2 (BLUFOR DI); M113A3 and M2A2/M3A2 (BLUFOR DI)
7.62mm Ball, API, API-T Machine Gun	BMP-2; T-62; T-64; T-72; T-80; BREM-1; 2S31; BMP-IP; BRDM 2 Recon; 2S23; BMP III; BTR-60; BTR-80
7.62mm Machine Gun A141, Ball & linked Tracer	M1A1; M1A2; M1025 w/M60; M2A2; M3A2; M981 FIST-V; Challenger; Chieftain; AMX 10ARC; AMX 10P; AMX 40; LEO

Table A-III. General Use Models

	IA4; LEO II, Marder 2: Warrior; M60 (BLUFOR DI); M113A3 and M2A2/M3A2 (BLUFOR DI)
73mm HEAT-FS, FRAG-HE	BMP-1P
ADM Stinger	ADM Stinger Missile Launcher (BLUFOR DI)
AGM 65 Maverick	A10; F16
AGM Hellfire	AH-64; OH-58D
AT-4	AT-4 (BLUFOR DI); M113A3 and M2A2/M3A3 (BLUFOR DI)
ATGM AT-10	BMP III; MT-12
ATGM AT-11	T-80; T-72B
ATGM AT-4	BMP/BTR Dismounts (AT-4 OPFOR DI)
ATGM AT-5	BRDM 2 w/AT5; BMP 2; BMP IP
ATGM AT-6	MI-24; MI-28; KA-50
ATGM AT-7 HEAT	BMP Dismounts (AT-7 OPFOR DI)
ATGM AT-8	T-80; T64B
ATGM TOW 2 BGM71D	M2A2; M3A2; M966 w/TOW; AH1S Cobra
Bomb(s), General Purpose MK82 LD low-drag MK82 AIR, air inflatable retarder MK82 HD (Snakeye I), high-drag MK84 LD low-drag MK84 AIR, air inflatable retarder BLU-109/B BLU-107/B (Durandal), parachute/rocket-boosted	Fixed Wing A10, F16 A10, F16 A10, F16 A10, F16 A10, F16 A10 F16
Bomb(s), Laser Guided GBU-10 (MK84 LGB) laser guided, low-drag	Fixed Wing A10, F16

Table A-III. General Use Models

GBU-12 (MK82 LGB) laser guided, low-drag	A10, F16
Bomb, Cluster Unit(s) CBU52B/B (delivers 220 BLU-61A/B bomblets) CBU58A/B (delivers 650 BLU-63A/B bomblets) CBU71A/B (delivers 650 BLU-86A/B bomblets) w/random fuze CBU87, air inflatable decelerator (delivers 202 BLU-97 bomblets) CBU89/B (GATOR) (delivers 72 BLU-91/B AT and 22 BLU-92/B AP mines)	Fixed Wing A10, F16 A10, F16 A10, F16 A10, F16 A10, F16
Bomb(s), General Purpose	SU-25, MIG-27, SU-17, SU-24
Bomb(s), Laser Guided	SU-25, MIG-27, SU-17, SU-24
Bomb, Cluster Unit(s)	SU-25, MIG-27, SU-17, SU-24
Dragon Anti-Tank Missile (Use Javelin visual model)	M47 Dragon BLUFOR DI; M113A3 and M2A2/M3A2 (BLUFOR DI)
GPU-5A Cannon (30mm)	F16
GAU-8 Avenger (30mm API)	A10
Javelin Anti-Tank Missile	AAWS-M BLUFOR DI; M113A3 and M2A2/M3A2 (BLUFOR DI)
M26 Tact 270mm Rocket w/M77 Warhead	M270/MLRS; M993
M26 Tact 270mm Rocket w/TGW Warhead	M270/MLRS; M993
Mine Clearing Line Charge	M58A3 MCLIC
Mine, Anti-Personnel (M16A1)	Engineers; BLUFOR Dismounts; M113A3 and M2A2/M3A2 (BLUFOR DI)
Mine, Anti-Tank (M21)	Engineers; BLUFOR Dismounts; M113A3 and M2A2/M3A2 (BLUFOR DI)
Mine, Anti-Personnel	OPFOR DI; GMZ

Table A-III. General Use Models	
Mine, Anti-Tank	OPFOR DI; GMZ
Explosive Demolition	Engineers
RPG-7V HEAT	RPG-7V, OPFOR DI
SA-13	SA-13
SA-15	SA-15
SA-16/18	Dismount ADA (MANPADS), SA-16/18 OPFOR DI
SA-19	2S6 Quad 30MM
Mine, Claymore Anti-Personnel (M18)	BLUFOR Dismounts; M113A3 and M2A2/M3A2 (BLUFOR DI)
L8A3 RP Smoke Grenade	M1A1; M1A2; M2A2/M3A2; M113A3; M981 FISTV
81mm, RP-Type Smoke Grenade	T-64; T-72; T-80; BMP-II; BMP-III; BTR-80
M87 Mine Cannister (BLU-92/B and BLU-91/B gator mines)	Volcano

APPENDIX B
DESIGN AND CONSTRUCTION

10. SCOPE.

This appendix describes the design and construction practices that shall be used to ensure a quality CCTT. This appendix is a mandatory part of the specification. The information contained herein is intended for compliance.

20. APPLICABLE DOCUMENTS.

20.1 Government documents.

The following documents of the exact issue shown form a part of this document to the extent specified herein. In the event of conflict between documents referenced herein and the contents of this specification, the contents of this specification shall be considered the superseding requirement.

20.1.1 Specifications, standards, and handbooks.

SPECIFICATIONS

FEDERAL

QQ-B-654 Amend 1	-	Brazing Alloys, Silver.
ZZ-R-765	-	Rubber Silicone (General Specification).
UL 94	-	Standard for Tests for Flammability of Plastic Materials for Parts in Devices and Appliances.

MILITARY

MIL-T-27	-	Transformers and Inductors (Audio, Power, and Supp 1B High Power Pulse), General Specification for.
MIL-W-80	-	Window, Observation, Acrylic Base, Anti-electrostatic, Transparent (for Indicating Instrument).
MIL-G-174		Glass, Optical.
MIL-C-675 Amend 3	-	Coating of Glass Optical Elements (Anti-Reflection).
MIL-S-867 Notice 1	-	Steel Castings, Corrosion Resisting Austenitic.

MIL-R-3065 Amend 1	-	Rubber, Fabricated Parts.
MIL-C-3133 Notice 1	-	Cellular Elastomeric Materials, Fabricated Parts.
MIL-G-3787 Notice 1	-	Glass, Laminated, Flat (except Aircraft).
MIL-P-5425	-	Plastic, Sheet, Acrylic, Heat Resistant.
MIL-R-6855 Supp 1	-	Rubber, Synthetic, Sheets, Strips, Molded or Extruded Shapes, General Specification for.
MIL-S-7124	-	Sealing Compound, Elastomeric, Accelerator Required, Aircraft Structure.
MIL-B-7883		Brazing of Steels, Copper, Copper Alloys, Nickel Alloys, Aluminum and Aluminum Alloys.
MIL-T-7928 1	-	Terminals, Lugs: Splices; Conductors: Crimp Supp Style, Copper, General Specification for.
MIL-W-8939	-	Welding, Resistance, Electronic Circuit Modules.
MIL-S-11030 Notice 1	-	Sealing Compound, Noncuring, Polysulfide Base.
MIL-O-13830 Amend3	-	Optical Components for Fire Control Instruments; General Specification Governing the Manufacture, Assembly and Inspection of.
MIL-F-14072 Amend 1	-	Finishes for Ground Signal Equipment.
MIL-P-15024 Supp 1A	-	Plates, Tags and Bands for Identification of Equipment.
MIL-W-18142 Amend 3	-	Wood Preservative Solutions, Oil-Soluble, Ship and Boat Use.
MIL-C-22750	-	Coating, Epoxy, VOC-Compliant.
MIL-P-23377		Primer Coatings: Epoxy, Chemical and Solvent Resistant.

MIL-G-25871 Amend 1	-	Glass, Laminated, Aircraft, Glazing.
MIL-C-39006/22 Amend 1A	-	Capacitors Fixed, Electrolytic (Nonsolid Electrolyte),Tantalum, (Polarized, Sintered Slug), 85 ^{o}C (Voltage Derated to 125 ^{o}C) Established Reliability, Style CLR79.
MIL-C-39006/25	-	Capacitors Fixed, Electrolytic (Nonsolid Electrolyte), Tantalum, Established Reliability, Style CLR81.
MIL-A-46106 Notice 1	-	Adhesive Sealants, Silicone RTV, General Purpose.
MIL-A-46146 Notice 1	-	Adhesive-sealant,, Silicone, RTV, Non-corrosive (For Use with Sensitive Metals and Equipment).
MIL-P-53030	-	Primer Coating, Epoxy, Water Reducible, Lead and Chromate Free.
MIL-P-55110 Amend 3	-	Printed Wiring Boards, General Specification for.
MIL-G-81704		Glass, Aircraft Instrument, Lighting Wedge and Cover.

OTHER GOVERNMENT AGENCY

NAVAL AIR SYSTEMS COMMAND (NAVAIRSYSCOM)

AS-4613	-	General Specification for Application and Derating Requirements for Electronic Components.

STANDARDS

FEDERAL

FED-STD-66	-	Steel, Chemical Composition and Hardenability.
FED-STD-406	-	Plastics: Methods of Testing.

MILITARY

MIL-STD-130	-	Identification marking of US Military Property.
MIL-STD-171	-	Finishing of Metals and Wood Surfaces.

MIL-STD-275 Notice 1	-	Printed Wiring for Electronic Equipment.
MIL-STD-454 Notice 2	-	Standard General Requirements for Electronic Equipment.
MIL-STD-889 Notice 2	-	Dissimilar Metals.
MIL-STD-1130 Notice 2	-	Connections, Electrical, Solderless Wrapped.
MIL-STD-1686		Electrostatic Discharge Control Program for Protection of Electrical and Electronic Parts, Assemblies, and Equipment.
MIL-STD-2000	-	Standard Requirement for Soldered Electrical and Electronic Assemblies.

HANDBOOKS

DOD-HDBK-263	-	Electrostatic Discharge Control Handbook for Protection of Electrical and Electronic Parts, Assemblies and Equipment (Excluding Electrically Initiated Explosive Devices).

(Copies of specifications, standards, drawings, and publications required by suppliers in connection with specific procurement functions shall be obtained from the contracting agency or as directed by the contracting officer.)

20.2 Non-government publications.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C1036	-	Standard Specification for Flat Glass.

(Application for copies should be addressed to the American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103-1137.)

INSTITUTE OF ELECTRICAL AND ELECTRONIC ENGINEERS (IEEE)

IEEE-STD-200	-	IEEE Standard Reference Designations for Electrical and Electronic Parts and Equipment.

(Requests for copies should be addressed to IEEE Service Center, 445 Hoes Lane, Piscataway, NJ 08854.)

30. DESIGN AND CONSTRUCTION.

Design and construction of CCTT hardware shall be in accordance with the following requirements.

30.1 Parts, materials, and processes.

Parts, materials, and processes shall be in accordance with the following requirements. Unless otherwise specified, nondevelopmental items (includes commercial off-the-shelf equipment) and GFE are exempt from these requirements. However, in order to be exempt, the hardware must comply with the conditions established by the Non-Developmental Item (NDI) and COTS definitions set forth in the SOW and must receive Government approval prior to contract award in accordance with the NDI qualification procedures of sections H and L of the contract.

30.1.1 Parts selection.

Only standard parts listed in the Government-Furnished Baselines (GFB) are authorized for use on the CCTT without any Government approval. Parts not listed in the GFBs shall be subject to review, approval, and disapproval actions in accordance with the parts control program procedures of SOW 881052.

30.1.1.1 Custom designed microelectronic devices.

Deleted

30.1.1.2 Microelectronic and semiconductor packaging.

All nonstandard microelectronic and semiconductor devices selected for Government approval shall be hermetically sealed in glass, metal, ceramic, or combination of these packages. “Plastic” (i.e., epoxy, silicone, phenolic, or other organic material) encapsulated or sealed devices shall not be used in the equipment, unless specific approval from the Government is obtained in accordance with the parts control program requirements of SOW 881052. No polymeric materials, greases, or desiccants shall be used in the package unless specified.

30.1.1.3 Electrostatic Discharge (ESD) sensitive parts.

Design application and selection of ESD sensitive parts shall be in accordance with MIL-STD-1686.

30.2 Materials.

Materials for all nonexempt equipment shall be as specified herein. Only those requirements for materials to be used in the fabrication of this device shall be applicable to this contract.

30.2.1 Arc-resistant materials.

Materials that require arc-resistance properties shall conform to Requirement 26 of MIL-STD-454.

30.2.2 Flammable materials.

Flammable materials shall not be used in the fabrication of CCTT unless approved in writing by the contracting officer.

30.2.3 Fungus-inert materials.

Fungus-inert materials shall be used and shall conform to Requirement 4 of MIL-STD-454.

30.2.4 Toxic materials.

Materials producing harmful toxic effects shall not be used.

30.2.5 Metals.

Metal parts shall be of a corrosion-resistant material (see 30.2.5.4) or of a material given a corrosion-resistant treatment or coating (see 30.3.5).

30.2.5.1 Iron and steel.

Cast iron shall not be used unless authorized by the contracting officer. Where enclosures, cases, frames, panels, brackets, and miscellaneous hardware are fabricated of steel, such steel material shall be treated to prevent corrosion as specified in 30.3.5. Corrosion-resistant steel castings shall conform to MIL-C-24707-3.

30.2.5.2 Magnesium.

The use of magnesium shall require written approval of the contracting officer.

30.2.5.3 Silver brazing alloy (silver solder).

Silver brazing alloy shall conform to QQ-B-654.

30.2.5.4 Corrosion-resistant metals.

The following are considered corrosion-resistant metals:

a. Copper.

b. Brass.

c. Bronze.

d. Copper-nickel alloy.

e. Nickel-copper alloy.

f. Copper-beryllium alloy.

g. Copper-nickel zinc alloy.

h. Nickel-copper-silicon alloy.

i. Nickel-copper-aluminum alloy.

j. Austenitic corrosion-resistant steels 302, 303, 304, 304L, 309, 310, 316, 316L, 322, 322A, and 347 as defined in FED-STD-66.

k. 30.2.5.5 Dissimilar metals.

The selection and protection of dissimilar metal combinations shall be in accordance with MIL-STD-889. Where electronic design requirements preclude the insulation of incompatible metal combinations as identified by MIL-STD-889 from one another, specific attention should be paid to isolating the combination from exterior environments.

30.2.6 Plastics

Plastic materials shall be as specified in 30.2.6 through 30.2.6.2. Plastic materials when tested in accordance with UL 94 and meeting the requirements of 94HB , 94V-1, or 94HF-1 may be used. Plastic materials when tested in accordance with UL 94 and not meeting the requirements of 94HB, 94V-1, or 94 HF-1 shall be considered FLAMMABLE and shall not be used.

30.2.6.1 Plastic dials and transparent and translucent parts.

Plastic for dials and other transparent and translucent plastics applications shall be in accordance with MIL-W-80. Material conforming to MIL-P-5425 or ASTM D3935 may be used, provided it is treated with an anti-electrostatic coating.

30.2.6.2 Composite materials.

Deleted

30.2.7 Hookup wire.

Hookup wire shall conform to Requirement 20 of MIL-STD-454.

30.2.8 Adhesive (glass-to-metal).

Glass-to-metal adhesives shall conform to MIL-S-11030 or MIL-S-7124.

30.2.9 Wood products.

Wood products shall be treated for preservation and fire-retardation and shall conform to commercial Grade B or better.

30.2.10 Glass.

Glare-proof glass shall be used when the equipment to be viewed will be illuminated from an outside source.

30.2.10.1 Glass (optical).

Optical glass used in the fabrication of lenses, prisms, reticles, first surface reflectors, and similar elements, shall conform to MIL-G-174 or MIL-O-13830.

30.2.10.2 Plate glass (optical).

Plate glass used in any portion of the image path shall conform to Class I, Grade C of MIL-G-174. For other applications, plate glass conforming to ASTM C1036 shall be used.

30.2.11 Rubber.

Except for the cellular rubber types of 30.2.11.1, rubber materials used for the absorption of noise, shock, vibration, or for application where resiliency is required, shall be in accordance with MIL-R-3065.

30.2.11.1 Cellular rubber.

Cellular rubber used for the absorption of noise, shock, vibration, or where resiliency is required, shall be in accordance with MIL-C-3133.

30.2.11.2 Synthetic rubber.

Where resistance to oil and fuel is required, general-purpose synthetic rubber conforming to MIL-R-6855 shall be used. Where resistance to low or high temperatures or tear resistance is required, silicone rubber conforming to ZZ-R-765 shall be used.

30.2.12 Lubricants.

The selection and application of lubricants shall conform to Requirement 43 of MIL-STD-454.

30.2.13 Encapsulating and embedding (potting compounds).

Selection of encapsulating and embedding compounds shall be in accordance with Requirement 47 of MIL-STD-454.

30.2.14 Other materials.

The following materials shall not be used unless approved in writing by the contracting officer:

a. Linen.

b. Cellulose acetate.

c. Cellulose nitrate.

d. Regenerate cellulose.

e. Jute.

f. Leather.

g. Deleted.

h. Paper and cardboard.

i. Organic fiberboard.

j. Hair or wood felts.

k. Plastic materials using cotton, linen or wood flour as a filler.

l. Radioactive material.

30.2.15 Recycled, virgin, and reclaimed materials.

Deleted

30.3 Processes.

Processes for the fabrication of non-exempt equipment shall be in accordance with the following requirements

30.3.1 Bonding, adhesive.

Adhesive bonding shall be in accordance with Requirement 23 of MIL-STD-454. Adhesive used for bonding shall develop the required strength needed for the application and shall meet the environmental requirements of the CCTT. Adhesives that give off volatile by-products, or vapors harmful to life, or contain corrosive substances, shall not be used.

30.3.2 Brazing.

Brazing of steel, copper, copper alloys, nickel, and nickel alloys shall be in accordance with MIL-B-7883.

30.3.3 Crimping of solderless terminal lugs.

Crimping of solderless terminal lugs shall be so accomplished that the connections will meet the tensile strength requirements and tests of MIL-T-7928.

30.3.4 Glass coating.

All optical glass requiring anti-reflective coatings shall be treated in accordance with MIL-C-675.

30.3.5 Protective finishes and coatings.

Finishes and coatings shall be in accordance with MIL-STD-171, except for passivation of stainless steel, which shall be in accordance with QQ-P-35 or ATSM A380. The essential requirements for paints shall be to avoid a multiplicity of primers and topcoats. Generally, the finish system shall be an epoxy primer with a polyurethane top coat. MIL-P-23377 and MIL-P-53030 are the preferred primers for use. MIL-C-22750 epoxy paint is the preferred topcoat for interior surfaces. Application and quality control of paints shall conform to the requirements of MIL-STD-171.

30.3.5.1 Painting, and preparation for.

In preparation for painting, after all machining, welding, and brazing operations are completed, the exterior and interior surfaces of all enclosures shall have all rust or other visible corrosive products and flux removed, and shall be thoroughly cleaned of all grease, oil, and dirt by solvent wiping, vapor degreasing, or caustic washing and rinsing.

30.3.5.2 Nonskid surfaces.

On painted surfaces where personnel normally step during CCTT use or maintenance, the surface shall be covered with nonskid paint or a suitable nonskid material.

30.3.5.3 Cadmium plating.

Cadmium plating shall not be used.

30.3.6 Corrosion prevention and control design prohibitions.

The following is a list of design practices not acceptable:

a. Crevices susceptible to moisture collection.

b. Not used.

c. Galvanic metal couples over 100 mV potential difference.

d. Printed circuit assemblies without conformal coating.

e. Moisture tight designs without proper seals.

f. Bearings without provisions for corrosion inhibiting lubrication (oil or grease).

g. Not used.

h. Not used.

i. Hardware requiring scheduled field maintenance for corrosion control.

30.3.6.1 Corrosion prevention and control materials prohibitions.

The following is a list of materials not acceptable:

a. Aluminum alloys 2024-T3 or T4; use T8 or 5000/6000 series.

b. Aluminum alloys 7075-T6; use 7075-T73, 7175-T7 or 7050 series.

c. Magnesium.

d. Precipitation hardening steels in H900, H950, or H100 tempers.

e. Graphite lubricants.

f. PVC and PVF plastics.

g. Corrosive type RTV including MIL-A-46106 (yields acetic acid during cure). Use MIL-A-46146.

h. Rubber that is susceptible to ozone damage.

i. Not Used.

j. Class 3 conversion coating on aluminum.

k. Cadmium, except as approved by the government.

l. Gold plated electrical coatings without nickel undercoating.

m. Silver plated electrical contacts.

n. Potting and foam material that are reversion prone.

o. Bare corrodible metal surfaces.

p. Materials not inherently moisture and fungus resistant.

30.3.6.2 Corrosion Prevention and Control.

Exterior rivets, lock bolts, blind rivits, and threaded fasteners shall be assembled using sealant conforming to MIL-S-81733. All other rivets, lock bolts, blind rivets, and threaded fasteners assembled through unfinished holes or threads shall be assembled using primer conforming to MIL-P-23377 or sealant conforming to MIL-S-81733.

30.3.7 Riveting.

Riveting shall be accomplished in accordance with Requirement 12 of MIL-STD-454.

30.3.8 Electrical soldering.

Electrical soldering shall be in accordance with MIL-STD-2000.

30.3.9 Solderless electrical connections (wrapped).

Solderless electrical connections (wrapped) shall be in accordance with MIL-STD-1130.

30.3.10 Welding.

Structural welding shall conform to Requirement 13 of MIL-STD-454. Resistance welding for electronic modules shall conform to MIL-W-8939.

30.3.11 Encapsulation and embedment (potting).

Encapsulation and embedment (potting) of a part or an assembly of discrete parts shall be in accordance with Requirement 47 of MIL-STD-454.

30.3.12 Wiring practices.

Internal wiring practices shall conform to Requirement 69 of MIL-STD-454.

40. IDENTIFICATION AND MARKING.

Identification and marking of parts, assemblies, and equipment shall be in accordance with Requirement 67 of MIL-STD-454, IEEE-STD-200, and the following requirements. Unless otherwise specified, these requirements are applicable to Trainer Unique Equipment (TUE).

40.1 Assemblies/Units/Modules/.

Assemblies and units shall be tagged in accordance with MIL-STD-130. Plug-in modules shall be keyed or permanently color coded so as to minimize the probability of incorrect connection/ insertion. Where keying or color coding is impractical, a permanent, legible directory or chart shall be posted conspicuously on or adjacent to the equipment, showing location or orientation of such module.

40.2 Commercial equipment marking.

Deleted

40.2.1 Commercial equipment identification, nameplates, and labels.

Deleted

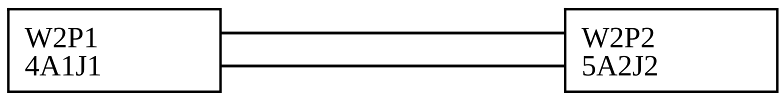
40.3 Cable and wire markings.

Cables and wires shall be permanently and legibly marked in accordance with MIL-STD-454 Requirement 67, and IEEE-STD-200. All disconnectable wires and cables shall be identified with “to” reference designators in addition to “W” and “P” designations. Types of disconnectables include plugs, jacks, lugged terminals, push-on captivated wires.

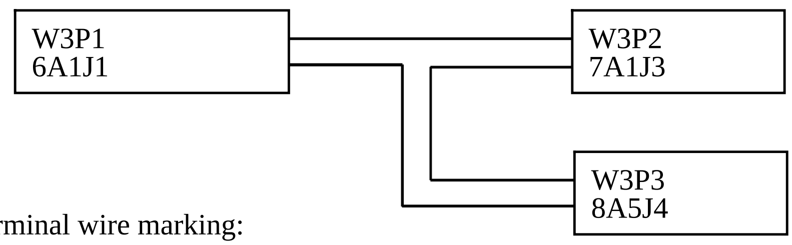
Ground wires, jumpers or links located on terminal boards, jacks or plugs are exempt from such marking. Markings shall not damage the wires or cables attached to and shall be located within approximately 200 millimeters from the terminal or plug, oriented in such a manner as to be readable without removal of the wire or cable or support clamps. Soldered or wire wrap connections shall be exempt from such marking.

Examples of cable end marking are as follows:

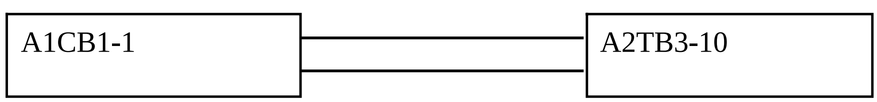
a. Basic inter-cabinet cable:



b. Multiple destination cable:



c. Terminal wire marking:



NOTES: UNIT NO. PREFIX MAY BE OMITTED FOR WIRES OR CABLES ENTIRELY LOCATED WITHIN THE SAME CABINET.
SUB-ASSEMBLY INTERNAL WIRING SHALL BE EXEMPT FROM THE REQUIREMENT OF THIS SPECIFICATION CALLING FOR THE "FROM" MARKING.

For purposes of this marking specification, units comprised of multiple cabinets or bays permanently welded or bolted together shall be considered as having separate cabinets.

The underlying criteria for wire and cable marking shall be ease of maintenance and reduction of chances for misconnection.

40.4 Terminals, boards, and strips.

Terminals, boards and strips shall be identified in a permanent manner to facilitate replacement of connections.

Where space limitations prohibit marking on the terminal, strip or board, the marking shall be on the chassis adjacent to the terminal, strip or board.

40.5 ESD marking.

Electrostatic discharge sensitive assemblies shall be marked in accordance with MIL-STD-1686. This requirement applies to TUE and NDI, including subcontracted equipment.

40.6 Fluid and gaseous lines marking.

Fluid lines shall be marked with the type of line; e.g., Supply, Return, Drain, Vent. All pressurized lines shall also be marked with the direction of flow. Where hazardous fluids or dangerous gases are utilized or where inadvertent cross connection of lines could result in a dangerous mixture, the material conducted by the lines shall also be marked. Marking shall be legible, permanent, and shall be on bands of material suitable for the environment, affixed with adhesive or other means which will assure permanency of attachment for the life of the CCTT without damage to the lines. Location of markers shall be within one foot of line connection points, oriented for readability by maintenance personnel.

40.7 CCTT nameplates and major unit markings.

Deleted

40.8 Warning marking for simulated and modified equipment.

The following types of CCTT equipment that can be removed without the use of tools shall be identified and marked "WARNING: FOR TRAINER USE ONLY" IAW ANSI Z535.4:

a. Modified operational/tactical equipment which is for CCTT use only.

b. Simulated equipment which has overall outward appearance which is substantially identical to the operational/tactical equipment for which it could be mistaken.

50. WORKMANSHIP.

Workmanship shall be in accordance with Requirement 9 of MIL-STD-454.

60. NOT USED.

70. POWER SUPPLY DESIGN.

Deleted

70.1 Output power density.

Deleted

70.2 Parts selection and application for power supplies.

Deleted

80. POWER SUPPLY DERATING CRITERIA.

Deleted

90. Printed wiring cards.

Printed wiring boards shall be designed and fabricated in accordance with requirements MIL-STD-275 and MIL-P-55110.

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APPENDIX C
OPERATIONAL MODE SUMMARY/MISSION PROFILE (OMS/MP) AND FAILURE DEFINITION AND SCORING CRITERIA (FD/SC)

10. SCOPE.

10.1 Identification.

This appendix contains the Operational Mode Summary/ Mission Profile (OMS/MP) and Failure Definition and Scoring Criteria (FD/SC) for the CCTT. The OMS/MP describes the anticipated mix of ways the CCTT will be used in carrying out its operational role, the relative frequency of the various missions, the percentage of time it will be exposed to each type of environmental condition during its life, and identifies the tasks, events, durations, operating conditions, and environment for each phase of a mission. The FD/SC describes the guidelines to be used for classifying RAM related incidents reported during testing and for chargeability for the root operational cause of failures, incidents, malfunctions, etc. Scoring in accordance with this paragraph establishes the database to be used by the RAM assessment conference and independent evaluators. (References to regiment and brigade level requirements are P^3I, see 3.9 of the specification).

20. APPLICABLE DOCUMENTS.

This section is not applicable to this appendix.

30. REQUIREMENTS.

The following sections identify the OMS/MP and FD/SC guidelines.

30.1 Operational mode summary.

a. Wartime. CCTT is a non-system training device that supports training in wartime as well as in peacetime. The major difference between its peacetime operational mode and its wartime operational mode will be in its frequency of utilization. During mobilization, when material and equipment ordinarily will be allocated to the war effort before it becomes available for institutional use, CCTT will be the bridge between training demand and training supply of tanks, fighting vehicles, fire support team vehicles, and other war material ordinarily available for training.

b. Peacetime.

   (1) This system will be used to train soldiers and leaders in the performance of collective tasks which must be done in order to accomplish combat missions. The system will be used to train soldiers of tank and fighting vehicle crews, fire support teams, tank and infantry platoons, company/teams, cavalry troops and squadrons, battalion/task forces, and selected combat support and combat service support elements.

   (2) The system will be used at the Armor and Infantry Schools for institutional training, and at various locations throughout the Army (active, reserve, and National Guard) to support armor, artillery, infantry, and combined arms unit tactical training. The system will be configured in platoon (4 or 7 simulators), cavalry troop (26

simulators), company/team (31 simulators), company/team and battalion Command Field Exercise (61 simulators), and battalion task force sets (98-150 simulators). The size of the set in any given location will depend upon the density of combat units located within or adjacent to that location. Institutional sets will be configured to meet institutional training requirements with an approximate size of a battalion task force minus. Platoon size sets in mobile configurations will be used to support United States Army Reserve (USAR) and National Guard (NG) unit tactical training at their respective armories (see para C.30.1h). Any USAR or NG unit in proximity to a CCTT site will have access to the simulation through that site's managing agency.

(3) Units that plan to use a CCTT site will schedule its use through the managing agency for that site. It will be the unit's responsibility to prepare training plans, scenarios, and evaluations in support of their training. Orientation to the equipment will be provided by personnel who are under contract to the Army for the purpose of operating, maintaining, and managing the site. After the unit is oriented to the operation of the simulator modules and emulator stations, the unit enters the simulators much the same as they would enter their actual vehicles or operating centers. From that point onward, the simulation should be nearly transparent to the unit that is undergoing training. The unit may do virtually anything in the simulator that it is capable of doing on the battlefield or on actual terrain during training.

(4) The unit commander who is training one of his subordinate units will evaluate the unit during and after training through the use of a computer- assisted after action review station. This station makes continuous video and data records of all the training unit's activities, and provides the commander the capability to conduct an after action review or to stop at convenient points during the exercise scenario, replay the scenario to that point, and conduct a during action review. At the conclusion of training, the commander evaluates the unit's performance by the standards in the mission training plan, and utilizes the computer-assisted after action review capability to illustrate the positive and negative aspects of the training and to plan remedial training as necessary.

c. The training mission required in both wartime and peacetime consists of 5 major segments as outlined below:

(1) Institutional training of the active force.

(2) Institutional training of USAR and NG.

(3) Unit training of the active force (CONUS and OCONUS).

(4) Unit training of USAR and NG.

(5) Joint operations training (CONUS and OCONUS, both active and USAR and NG).

d. CCTT will be utilized for:

(1) Unit sustainment training, crew through battalion/task force (active/ reserve component units equipped with M2/M3/FIST-V, etc.).

(2) Institutional training bases (Fort Benning, Fort Knox).

e. Unit sustainment training will consist of the following type of events (Figure C-1 indicates notional percentages of use for platoon, company and battalion events by site type).

(1) Platoon training at a platoon level site.

(2) Company (leader only) training at a platoon site.

(3) Single platoon training exercise at a company/team or troop site or company/team Bn CFX site.

(4) Multiple platoon training at a company/team or troop site or company/team Bn CFX site.

(5) Company/team or troop training at a company/team or troop site or company/ team Bn CFX site.

(6) Battalion/squadron (leader and staff only) training at a company/team or troop site or company/team Bn CFX site.

(7) Multiple platoon training at a battalion/task force site.

(8) Company/team or troop training at a battalion/task force site.

(9) Balanced task force training at a battalion/task force site. Squadron (-) training at a battalion/task force site.

(10) Task force training at a battalion/task force site with collocation of other simulation systems, such as AVCATT.

f. Institutional training at USAIS (Fort Benning) will utilize the system as indicated in Figure C-3 for peacetime and in Figure C-4 for wartime for the following courses.

(1) Infantry Officer Basic Course (IOBC).

(2) Infantry Officer Advance Course (IOAC).

(3) Infantry Precommand Course (PCC).

(4) Advanced NCO Course (ANCOC).

(5) Bradley Commander Course (BCC).

(6) Bradley Master Gunner Course (BFV MG CS).

(7) Basic Non-Commissioned Officer Course (BNCOC) MOS 11M, Mechanized Infantryman.

g. Institutional training at USAARMS (Fort Knox) will utilize the system as indicated in Figure C-5 for peacetime and Figure C-6 for wartime for the following courses:

(1) Armor Officer Basic Course (AOBC).

(2) Armor Officer Basic Course (Reserve Component) (AOBC RC).

(3) Armor Officer Advanced Course (AOAC).

(4) Armor Officer Advance Course (Reserve Component) (AOAC RC).

(5) Armor Precommand Course (PCC).

(6) Advanced Non-Commissioned Officer Course - Scout (ANCOC SCT).

(7) Advanced Non-Commissioned Officer Course - Armor (ANCOC AR).

(8) Third Class Combined Arms Training (TCCAT).

h. Reserve Component (RC) mobile platoons will be utilized in peacetime and wartime as follows:

(1) Weekend training at the armory. Regional utilization of mobile platoon size systems is planned for 42 weekend training sessions per year. Normal sequence intends on setting up on Friday with a readiness for operation NLT 1600 hours for exercise planning until 2200. Training from 0800 to 1800 hours Saturday and Sunday. Movement preparation on Monday. Tuesday through Thursday to cover movement time to next location (44 estimated moves per year).

(2) Periodic training at Unit Training Equipment Sites (UTES), Maintenance Activity Training Equipment Sites (MATES), or Major Training Areas (MTA's) will be accomplished with normal operation extending for up to four two week period(s) instead of curtailing on Monday. Training will usually be accomplished from 0800 to 1800 hours daily. In this mode, mobile simulators may be linked to other systems to provide for higher echelons of training.

(3) Fixed platoon or shared usage of AC fixed sites is envisioned as two 10 hour periods, 0800 to 1800 hours on weekends. Unit densities will vary the number of weekends of fixed site training, however, it is envisioned to be two weekends per month initially.

(4) In wartime, it is envisioned that the mobile simulators will be moved to equipment sites or mobilization sites. Training will correlate to periodic training described above. Training hours will be extended to 20 hours per day, 363 days per year.

30.2 Mission profile.

a. Mission profile.

(1) Events. The following events are characteristic of any type of exercise conducted on the system, in either a fixed unit or institutional site:

(a) Event 1: Set up and PM:

1.1 Activate network, emulation stations, and simulators on the network.

1.2 Run diagnostics.

(b) Event 2: Initialize exercise parameters:

2.1 Assign simulator modules.

2.1 Designate into organizations.

2.1.2 Designate vehicle model, i.e., M2 versus M3.

2.1.3 Designate vehicle status, i.e., vehicle Class III and V load levels, maintenance status, etc.

2.1.4 Designate vehicle location on the terrain database, orientation of vehicle.

2.2 Assign supporting emulation stations.

2.2.1 Tactical Air Control Party.

2.2.2 Engineer.

2.2.3 Field artillery fire support.

2.2.4 Logistics.

2.2.5 Maintenance.

2.2.6 Not used.

2.2.7 Mortar platoon.

2.2.8 Aviation support station.

2.2.9 Semi-Automated Forces (SAF).

2.3 Assign controlling parameters:

2.3.1 Ammunition resupply rate by type.

2.3.2 Fuel resupply rates.

2.3.3 Number CAS sorties.

2.3.4 Number and a type of available aviation support assets.

2.4 Assign SAF parameters:

2.4.1 Opposing/friendly forces:

2.4.1.1 Size

2.4.1.2 Types of units.

2.4.1.3 Role.

2.4.1.4 Class III and V support.

(c) Event 3: Train (duration is variable).

3.1 Alert time awaiting exercise action.

3.2 Exercise events.

3.3 After-action review (simulators are in standby/alert mode/or being repositioned to a selected start point).

3.4 Restart for additional repetitions.

(d) Event 4: Standby/alert time.

(e) Event 5: Standby/or shut down.

5.1 PM checks.

5.2 Turn off simulators/power down network.

(f) Daily notional profiles: The profiles of daily basic utilization of the system by events are shown in Figure C-2. Normal operating times are based on 10 and

20 day mission durations. The normal time for event 3 (training) will be in either 4 hour increments or based on mission durations listed in Figures C-7 through C-10.

(2) Hours of utilization for institutional training are shown in Figures C-3, C-4, C-5, and C-6.

(3) Notional mission profiles are indicated as follows: (CAVEAT: All examples are notional land times to conduct missions will vary depending on local training situation.)

(a) Mech platoon: figure C-7.

(b) Tank platoon: figure C-8.

(c) Company/team: figure C-9.

(d) Battalion task force: figure C-10.

(4) Climatic environment:

(a) Basic category: 100 percent.

(b) Environmental protection: System will be located in fixed sites or mobile shelters.

(c) Operating temperature range: 60 to 80 degrees Fahrenheit.

(d) Humidity range: 5 percent to 90 percent non-condensing.

(e) No movement during operation. Mobile type systems will be transported over 80 percent primary and 20 percent secondary roadways.

(5) Processing activities:

(a) Input from simulator controls 45 percent

(b) Input from emulator stations 25 percent

(c) Input from semi-automated OPFOR 30 percent

(d) Recording activities: Record data packages 100 percent

TYPE SITE	NO. MOD AVAIL	AVG % USE PLT EVENTS	AVG %USE CO EVENTS	AVG % USE BN EVENTS
Tk Plat	4	75.00%	25.00%	.00%
BFV Plat	7	75.00%	25.00%	.00%
Regt Cav Trp	26	49.00%	33.00%	.00%
Co/Tm	31	29.00%	33.00%	.00%
Co/Tm Bn CFX	61	34.00%	36.00%	13.00%
BN/TF (Bal)	98	41.00%	45.00%	16.00%

Note: Based upon current fielding plan.

Figure C-1. Site Utilization By Type Event

LENGTH OF DAY (HOURS)	NUMBER OF EVENT OCCURRENCES DAILY					PMCS HOURS AVAILABLE
	EVENT 1	EVENT 2	EVENT 3	EVENT 4	EVENT 5	
10	1	2	2	1	1	14
16	1	3	3	1	1	8
20	1	4	4	1	1	4
> 24 CONOPS	1	6	7	1	1	0

Figure C-2. Daily Notional Utilization

(1) USAIS COURSE TITLE	(2) CLASSES PER YEAR	(3) STUDENTS PER CLASS	(4) HOURS PER CLASS	(5) SIMULATORS PER CLASS	(6) SIMULATOR HOURS PER YEAR
IOBC	13	200	32	67	27872
IOAC	6	185	32	62	11904
PCC	6	20	24	10	1440
ANOC	5	190	24	64	7680
BCC	8	44	40	15	4800
BFV MG CRS	4	44	20	44	3520
BNCOC (11M)	5	40	20	40	4000

Hours available Annually:	147,400
(67 Simulators x 220 Training Days x 10 Hours)	
(Only Tank, BFV, and M113A3 modules are counted for institutional training purposes.)	
Hours used in institutional training:	61,216
Percent usage for institutional training:	41.53%

Figure C-3. United States Army Infantry School Institutional Usage Peacetime

(1) USAIS COURSE TITLE	(2) CLASSES PER YEAR	(3) STUDENTS PER CLASS	(4) HOURS PER CLASS	(5) SIMULATORS PER CLASS	(6) SIMULATOR HOURS PER YEAR
IOBC	25	200	32	67	53600
IOAC	5	185	32	62	9920
PCC	10	44	40	15	6000

Hours available Annually:	486,420
(67 Simulators x 220 Training Days x 10 Hours)	
(Only Tank, BFV, and M113A3 modules are counted for institutional training purposes.)	
Hours used in institutional training:	69,529
Percent usage for institutional training:	14.29%

Figure C-4. United States Army Infantry School Institutional Usage Wartime

(1) USAARMS COURSE TITLE	(2) CLASSES PER YEAR	(3) STUDENTS PER CLASS	(4) HOURS PER CLASS	(5) SIMULATORS PER CLASS	(6) SIMULATOR HOURS PER YEAR
AOBC	16	72	24	18	6912
AOB RC	2	50	46	42	3864
AOAC	4	160	46	42	7728
AOAC RC	2	24	46	14	1288
PCC	5	18	12	12	720
ANCOC SCT	3	80	24	27	1944
ANCOC ARMOR	6	80	20	42	5040
TCCAT	8	150	2	89	1424

Hours available Annually:	160,600
(73 Simulators x 220 Training Days x 10 Hours)	

(Only Tank, BFV, and M113A3 modules are counted for institutional training purposes.)
Hours used in institutional training: 28,920

Percent usage for institutional training: 18.01%

Reminder of available hours are anticipated to be shared utilization with MTO&E and TDA unit training requirements.

Figure C-5. United States Army Armor School Institutional Usage Peacetime

(1) USAARMS COURSE TITLE	(2) CLASSES PER YEAR	(3) STUDENTS PER CLASS	(4) HOURS PER CLASS	(5) SIMULATORS PER CLASS	(6) SIMULATOR HOURS PER YEAR
AOB MOB	52	96	46	32	76544
AOAC #	0	69	46	23	0
SCT PLT LDR	65	24	24	24	37440
PCC	7	16	24	16	2688
NCO TK CDR	63	100	46	34	98532
USAARMS OCS	52	96	46	32	76544

SOAC is an on-order requirements from Hq DA.

Hours available Annually: 529,980
(73 Simulators x 220 Training Days x 10 Hours)
(Only Tank, BFV, and M113A3 modules are counted for institutional training purposes.)
Hours used in institutional training: 291,748

Percent usage for institutional training: 55.05%

Remainder of available hours will be for unit collective training of crew, platoons, companies or battalions.

Figure C-6. United States Army Armor School Institutional Usage Wartime

MISSION	(1) SETUP/PM DIAGNOSTICS #	(2) INITIALIZE EXERCISE ##	(3) TRAINING EXERCISE ###	(4) STANDBY TIME ####	(5) SYSTEM SHUTDOWN #####
MOVEMENT	.75	.25		.30	.50

TO CONTACT					
Tactical Road March			1.00		
Occupy Assembly Area			1.00		
Prepare for Combat			.25		
Move Tactically			.50		
React to Contact			.25		
Assault Mounted			.25		
Consolidate and Reorganize and After Action Review			.75		
TOTALS:	.75	.25	4.00	.30	.50

Figure C-7. Mechanized Infantry Platoon Mission Profile (Notional)

NOTES:

System setup, preventive maintenance, and diagnostics are performed each day when exercises are conducted “back-to-back”. The time required for this activity is charged to the full day’s activities.

Initialization requires the input of number and types of vehicles, basic loads, personnel status, maintenance posture, and other vital information from the unit that is to be trained. This requirement must be met prior to each new unit beginning its training.

Training exercise time will vary for each mission and for each unit that trains on the simulation. These times are representative; they will vary by as much as the commander deems necessary to meet the training needs of his unit.

Total standby time will vary, however, these numbers are representative of the total time the training unit will be issuing operations orders or fragmentary orders.

The system is expected to require technical expertise to shut down, and the time allocated to this activity is expected to be sufficient to allow an experienced technician to shut down the system.

Note: This mission profile illustrates only a notional application. Times are in hours or fractions of hours.

MISSION/TASK	**(1) SETUP/PM DIAGNOSTICS**	**(2) INITIALIZE EXERCISE**	**(3) TRAINING EXERCISE**	**(4) STANDBY TIME**	**(5) SYSTEM SHUTDOWN**

	#	##	###	####	#####
MOVEMENT TO CONTACT					
Conduct a Hasty Attack	.50	.50		.25	.25
Prepare for Tac Opening			1		
Conduct a Hasty Attack			1.50		
Perform Con and Reorg			.50		
TOTALS:	.50	.50	3	.25	.25

Figure C-8. Tank Platoon Mission Profile (Notional)

NOTES:

\# System setup, preventive maintenance, and diagnostics are performed each day when exercises are conducted “back-to-back”. The time required for this activity is charged to the full day’s activities.

\## Initialization requires the input of number and types of vehicles, basic loads, personnel status, maintenance posture, and other vital information from the unit that is to be trained. This requirement must be met prior to each new unit beginning its training.

\### Training exercise time will vary for each mission and for each unit that trains on the simulation. These times are representative; they will vary by as much as the commander deems necessary to meet the training needs of his unit.

\#### Total standby time will vary, however, these numbers are representative of the total time the training unit will be issuing operations orders or fragmentary orders.

\##### The system is expected to require technical expertise to shut down, and the time allocated to this activity is expected to be sufficient to allow an experienced technician to shut down the system.

Note: This mission profile illustrates only a notional application.

MISSION	**(1) SETUP/PM DIAGNOSTICS #**	**(2) INITIALIZE EXERCISE ##**	**(3) TRAINING EXERCISE ###**	**(4) STANDBY TIME ####**	**(5) SYSTEM SHUTDOWN #####**
MOVEMENT TO CONTACT	.75	.50	4	1	.50

Attack	.75	.50	4	1	.50
Defend	.75	.50	8	1	.50
Raid	.75	.50	6	1	.50
Ambush	.75	.50	2	.50	.50
Recon & Security	.75	.50	2	.50	.50
Retrograde	.75	.50	4	.50	.50

Figure C-9. Company/Team Mission Profile (Notional)

NOTES:

System setup, preventive maintenance, and diagnostics are performed each day when exercises are conducted "back-to-back". The time required for this activity is charged to the full day's activities.

Initialization requires the input of number and types of vehicles, basic loads, personnel status, maintenance posture, and other vital information from the unit that is to be trained. This requirement must be met prior to each new unit beginning its training.

Training exercise time will vary for each mission and for each unit that trains on the simulation. These times are representative; they will vary by as much as the commander deems necessary to meet the training needs of his unit.

Total standby time will vary, however, these numbers are representative of the total time the training unit will be issuing operations orders or fragmentary orders.

The system is expected to require technical expertise to shut down, and the time allocated to this activity is expected to be sufficient to allow an experienced technician to shut down the system.

Note: This mission profile illustrates only a notional application.

MISSION	(1) SETUP/PM DIAGNOSTICS #	(2) INITIALIZE EXERCISE ##	(3) TRAINING EXERCISE ###	(4) STANDBY TIME ####	(5) SYSTEM SHUTDOWN #####
Recon & Security	.50	.75	2	1	.50
Movement to Contact	.50	.75	2	1	.50
Attack	.50	.75	2	1	.50
Defend	.50	.75	4	.25	.50

Figure C-10. Battalion/Task Force Mission Profile (Notional)

NOTES: Times are in hours or fractions of hours.

This activity is done only once. (At the beginning of the training day.)

This activity is required once per exercise.

This activity is done only once. (At the end of the training day.)

30.3 Failure Definition and Scoring Criteria (FD/SC).

30.3.1 Mission Essential Functions (MEFs).

The MEF of the system shall be to successfully complete a training exercise without a termination in training, without interruptions in training, or without training degraded to the point that the trainer or instructor determines it is ineffective to continue training. The failure of the following are defined as failures which terminate, interrupt, or degrade training:

a. Training will be terminated when:

(1) There is a failure of the network or control of the network so that communications between one or more nodes, the AAR, SAF, or more than 10 percent of the simulator modules are terminated.

(2) The AAR console cannot provide for the recording, observation, event marking, playback of a simulated exercise communications between the training instructor/observer and the training audience.

(3) The SAF cannot provide representation of semi-automated forces of both friendly and threat formations up to the regiment or brigade level with the following capabilities:

(a) Represent the movement of the vehicles on the simulated terrain database in response to the directions of the SAF operator controls.

(b) Represent the operational characteristics of the vehicle being simulated with the appropriate speed, terrain maneuverability, logistical consumption rates, weapons system capabilities and effects, vulnerabilities, and survivability.

(c) Provide the operator(s) with visual representations which are representative of and relative to the size, movement, shape, and location of the simulated vehicles, cultural features, and terrain.

(d) To provide communications and representations that transmit and receive voice communications within the simulated military radio channels to operator positions and between simulators and emulation stations.

(4) In the opinion of the senior instructor or trainer, that the number and frequency of training interruptions training degradations make continued use of the simulation ineffective.

(5) More than 10 percent of the simulator modules in a given site are no longer mission capable or when more than 10 percent of the training audience of a given exercise could not be trained.

(6) A critical or catastrophic hazard to personnel or equipment exists as defined by MIL-STD-882B, 1 Jul 87.

b. Training will be interrupted when:

(1) The Operations Center(s) cannot provide:

(a) The ability to have maintenance support to move, fix, and repair deterministic maintenance failures in response to appropriate input by maintenance console operator.

(b) The movement and resupply of ammunition in response to the appropriate input by the logistics console operator.

(c) The movement and resupply of fuel in response to the appropriate input by the logistics console operator.

(d) Fire support functions into the simulation when required for use.

(e) Close air support functions into the simulation when required for use.

(f) Engineer operations functions into the simulation when required for use.

(2) The CCTT simulator module(s) cannot:

(a) Represent the movement of the simulator as a vehicle on the simulated terrain database in response to the functioning of the operators controls.

(b) Represent the operational characteristics of the vehicle being simulated with the appropriate speed, sound, vibrations, terrain maneuverability, logistical consumption rates, weapons system capabilities and effects, vulnerabilities, survivability, and visual systems.

(c) Provide the operator(s) with visual representations which are representative of and relative to the size, movement, shape, and location of the simulated vehicles, cultural features, and terrain.

(d) Provide communications and representations that transmit and receive voice communications within the simulated military radio channels to operator positions and between simulators and emulation stations.

(e) Display the effects of deterministic failures.

(f) Provide a compass capability presented in degrees, depicting the orientation of the long axis of the vehicle on the simulated terrain to grid north.

(3) In the opinion of the senior instructor/trainer determines that a portion of the simulation which he considers essential to his training objective is not operational but the maintainer of the system has indicated can be made operational within a time interval acceptable to the trainer.

c. Training will be degraded when:

(1) The simulation system is no longer capable of conducting more than one exercise simultaneously.

(2) A simulator module loses the following:

(a) One but not all of its visual representations in a single crew position where more than one visual representation is present.

(b) Communications in one but not all the crew positions of the simulated vehicle, if there is more than one crew position.

(c) Any of a simulated vehicle's characteristics that are not designated as non-mission capable failures in the represented vehicle operators manual.

(3) In the opinion of the senior instructor/trainer that one or more elements of the simulation system required for use to support his immediate training objectives are not available for training.

30.3.2 Classification/chargeability guidelines.

Figure C-11 is a flow chart which provides the classification and chargeability for failure definition and scoring criteria for failures. Below is an explanation of the steps necessary to determine the proper procedures to be taken:

FAILURE DEFINITION AND SCORING CRITERIA INCIDENT SCORING GUIDELINES

STEP 1 - **No Test**

(1) Is this incident a "no test?"

(2) If the answer is "yes", score as "no test" and stop. If it is "no", proceed to step 2.

(3) Amplification: "no test" conditions include:

(a) Malfunctions that can be attributable to sources outside of the simulation system or its hardware, i.e., failure of electrical service to the facility.

(b) Test Peculiar. Malfunctions caused by test instrumentation. Engineering evaluations performed to determine cause of malfunction.

(c) Accidents. Acts of God such as lightning, flood, or earthquake. Accidents caused by crew or operators will be scored on their own merit.

(d) Deliberate Abuse. Incident report which describes willful abuse as cause of failure. (Attributed to persons or persons unknown.)

(e) Not RAM Oriented. Incident reports which describe suggested improvements, human factors problems, etc., and are not pertinent to evaluating RAM. Reports on the consistent inability to meet performance specifications even though no actual malfunctions has occurred.

STEP 2 - **Is training terminated**?

(1) Was the incident a malfunction which caused the training exercise to be terminated?

(2) If "no", go on to step 3.

(3) If "yes", classify the incident as an Operational Mission Failure (OMF) and record the following:

(a) Calendar clock time.

(b) Record clock minutes. (Maint clock minutes and maint man-minutes used).

(c) Identify the component(s). (Spares used and repair parts used by subsystem or component.)

(4) Expansion: If training is terminated because one or more subsystem(s) is affected score as an OMF. Subsystems may include the network, work-station(s), simulator(s), or simulator subsystem(s) or any combination thereof. Alternately, if a subjective judgement is made by the person in charge of training that training interruptions are so frequent that training cannot be conducted effectively, score as an OMF. Also an OMF will be scored if a critical or catastrophic hazard exists as defined in paragraph 4.5.1 of MIL-STD-882B, System Program requirements, 1 July 87. Then proceed to step 5.

STEP 3 - **Training interruptions**.

(1) Was the incident a malfunction which caused the training exercise to be interrupted?

(2) If yes, score as an OMF, and record the following:

(a) Record calendar clock minutes.

(b) Record clock minutes. (Maint clock minutes and maint man-minutes used.)

(c) Identify the component(s). (Spares used and repair parts used by subsystem or component.)

(3) If no, proceed to step 4.

(4) Expansion: If training is interrupted at a frequency and/or at a time which causes an exercise or mission to be incomplete and training to become ineffective because of one or more subsystem(s) is affected score as an OMF. Subsystem(s) may include the network, work-station(s), simulator(s) or simulator subsystem(s) or any combination thereof. Alternately, if a subjective judgement is made by the person in charge of training that training interruptions are so frequent that training cannot be conducted effectively, return to step 2.

STEP 4 - **Training degradations**.

(1) Was the incident a malfunction which caused the training exercise or the performance of training to be degraded?

(2) If yes, record the following:

(a) Record calendar clock minutes.

(b) Record clock minutes. (Maint clock minutes and maint man-minutes used.)

(c) Identify the component(s). (spares used and repair parts used by subsystem or component.)

(d) Log the type of degradation and it's effect on training objectives.

(3) If no, proceed to step 5.

(4) Expansion: If training is degraded at a frequency or at a time which causes an exercise or mission to be incomplete and training to become ineffective because of one or more subsystem(s) is affected log the degradation and its affect on training. Subsystem(s) may include the network, workstation(s), simulator(s) or simulator subsystem(s) or any combination thereof. Alternately, if a subjective judgement is made by the person in charge of training that training interruptions are so frequent that training cannot be conducted effectively or that training objectives cannot be met, return to step 3.

STEP 5 - **Identification of chargeable element**.

(1) What operational element was primarily responsible for the incident?

(2) Assign to one of the following categories:

(a) Chargeable to Hardware (CH) {Identify Component}.

(b) Chargeable to Software (CS) {Identify Component}.

(c) Chargeable to Operator (CO) {Identify Component}.

(d) Chargeable to Crew (CC).

(e) Chargeable to Maintenance Personnel (CMP).

(f) Chargeable to Manuals (CM).

(g) Chargeable to Support Equipment (CSE) {Identify Component}.

(h) Chargeable to Accident (CA).

(3) Amplification. This step assigns chargeability for all failures to the root cause of the failure. Do not assign chargeability to incidents scored as “no test”.

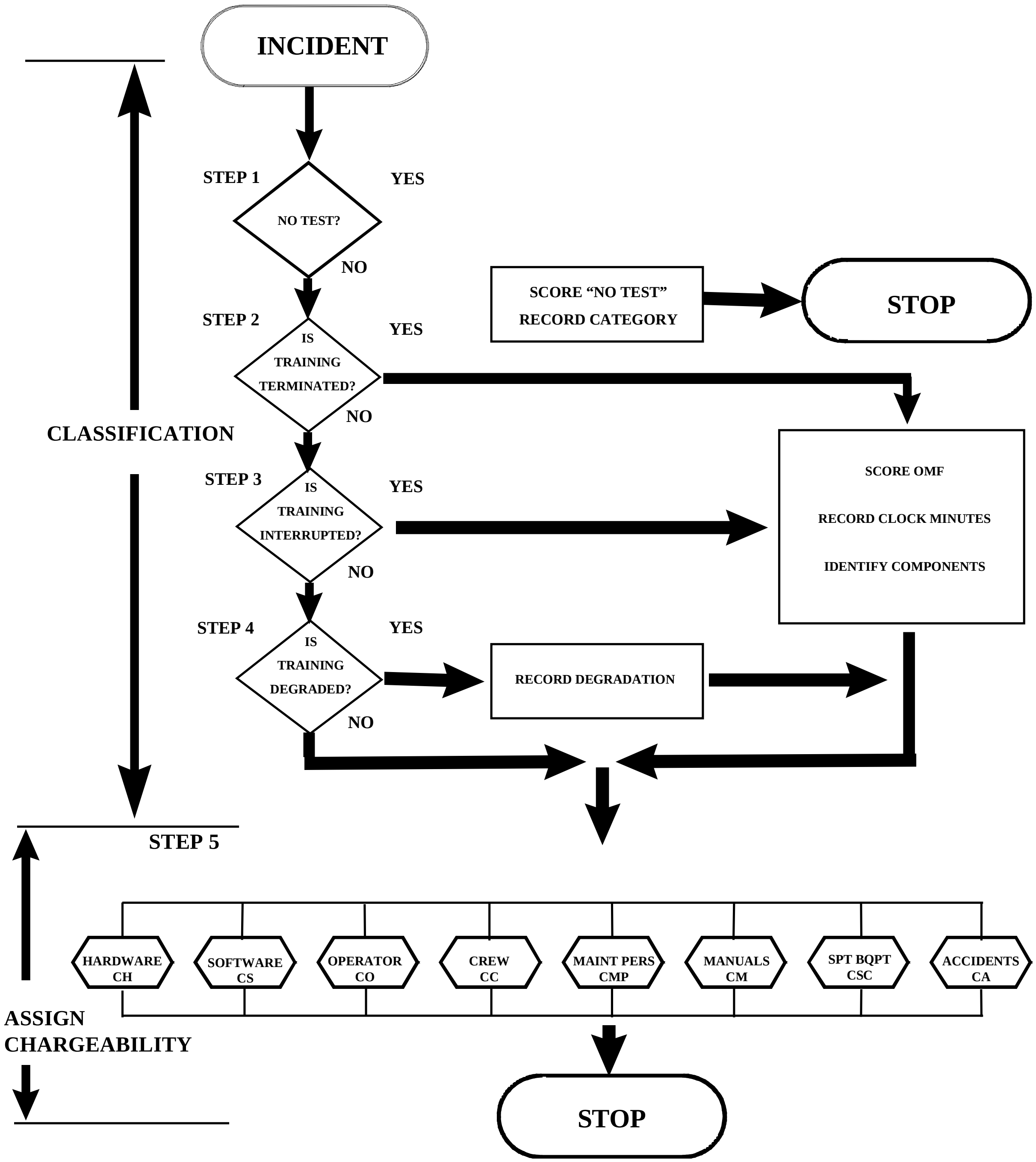

Figure C-11. Failure Definition/Scoring Criteria Classification/Chargeability Flow Chart

APPENDIX D

NOT USED

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APPENDIX E

SYSTEM SAFETY DESIGN VERIFICATION CHECKLIST FOR THE CLOSE COMBAT TACTICAL TRAINER SYSTEM

10. Scope.

This appendix establishes a partial system safety design verification checklist for the CCTT program. This appendix forms part of the Prime Item Development Specification (PIDS) for the CCTT system and is to be interpreted as though it were a paragraph embedded in the PIDS.

20. Applicable Documents.

30. Requirements.

30.1 Electrical.

30.1.1

Are operating personnel protected from accidental contact with voltages in excess of 30 volts?

30.1.2

Does each contact, terminal or like device, having voltages between 70 and 500 volts, rms or DC, with respect to ground, have barriers or guards to minimize accidental contact by operating or maintenance personnel?

30.1.3

Are barriers or guards that protect terminals or like devices exhibiting 70-500 volts, clearly marked to indicate highest voltage encountered upon its removal? (ANSI Z535.3/4)

30.1.4

Are portions of assemblies operating at potentials above 500 volts, RMS or DC, completely enclosed from the remainder of the assembly, and is the enclosure provided with non-bypassable interlocks?

30.1.5

Are enclosures for potentials, which exceed 500 volts, marked "DANGER, HIGH VOLTAGE, XXX VOLTS", in white on a red background?

30.1.6

Do all circuits and capacitors discharge 30 volts or less within no more than two seconds after power is removed?

30.1.7

If the answer to question 1.6 is NO, are the high-voltage capacitors of circuits automatically discharged when the case or rack is opened?

30.1.8

Are test points provided in equipment where measurement of potentials in excess of 300 volts is required?

30.1.9

Are test points designed to require plug-in, not clamp-on, test instruments?

30.1.10

Are green or red indicator lamps provided to indicate “power on”?

30.1.11

Is sufficient space provided between shield endings and exposed conductors to prevent shorting or arcing?

30.1.12

Are electrical conductors designed to prevent insertion of the wrong plug into a receptacle or other mating unit?

30.1.13

Are plugs and receptacles coded and marked to clearly indicate mating connectors, where those of similar configuration are in close proximity?

30.1.14

Are plugs and receptacles designed to preclude electrical shock and burns while being disconnected?

30.1.15

Are male plugs de-energized when disconnected?

30.1.16

Are dissimilar plug/receptacle pairs used in units containing explosives?

30.1.17

When equipment is designed to operate on more than one type of input power, does the connector design prevent connection or use of improper power?

30.1.18

Are single-phase power cables properly color coded: black: hot white: neutral green: ground?

30.1.19

Are three-phase power cables coded as in Question 1.18, above, with the second and third phases in red and blue, respectively?

30.1.20

Are meter terminals protected from voltages of 70 volts or more?

30.1.21

Do probes that are part of or accessories to the equipment contain safety guards that prevent contact with the tip and is the length of the exposed portion of the tip not more than 0.75 inches? (This question does not apply if the voltages to be measured are less than (a) 30 volts rms, (b) 60 volts DC, or (c) 24.8 volts DC interrupted at a rate of 10 Hz to 200 Hz.)

30.1.22

Are current and voltage overload protection devices provided?

30.1.23

Except for antennas and transmission line terminals, are all external parts, surfaces, and shields at ground potential at all times?

30.1.24

Is the path from the equipment to ground continuous and permanent?

30.1.25

Is the ground wire color coded green or green with yellow stripes? (NFPA 70-87 [400.23])

30.1.26

Does the ground have capacity to safely conduct any currents that might be imposed thereon?

30.1.27

Is the ground wire separate from electrical circuits, i.e., not tied to neutral?

30.1.28

Has a test been conducted to determine the amount of leakage current on the grounding conductor? If YES, indicate the amount of current, in milliamperes, that was measured. (NFPA 70-87 [250-21])

30.1.29

Is the impedance of the path from the equipment tie point to ground sufficiently low to limit the potential drop and to allow the operation of overcurrent devices in the circuits?

30.1.30

Does the path from the equipment tie point to ground have sufficient mechanical strength to minimize accidental ground disconnection?

30.1.31

Is the ground connection to the chassis or frame secured by one of the following: Spot welded terminal lug, Soldering lug, Screw, Nut, and Lockwasher?

30.1.32

On transmitting equipment, is a grounding stud provided that permits attachment of a portable shorting rod?

30.1.33

Except for RF voltages, are antenna and transmission at ground potential?

30.1.34

Do convenience outlets automatically ground the mated plugs of metal-cased portable tools and equipment?

30.1.35

Are both the phase and neutral supply voltage lines not connected to the chassis?

30.1.36

Are wires and cables supported and terminated to prevent shock and fire? (29 CFR 1910.305)

30.1.37

Are DC power connections color coded and marked for polarity?

30.1.38

Does the main power switch cut off all the complete equipment?

30.1.39

Is the main power switch clearly identified?

30.1.40

Is the main power switch located on the panel? (29 CFR 1910.303)

30.1.41

Is physical protection provided from accidental contact with the power input side of the main power switch and the incoming power line connections?

30.1.42

Are power switches located such that they cannot be operated by accidental contact?

30.1.43

Are provisions provided to deactivate mechanical drive units (switch, circuit breakers, etc) without disconnecting other parts of the equipment?

30.1.44

Are means provided to cut off power while installing or replacing an item of equipment or an assembly or part thereof?

30.1.45

Are emergency controls readily accessible and clearly identified?

30.1.46

Does the equipment use batteries? If YES, indicate whether batteries are the primary or backup power source.

30.1.47

Is the battery in the Government inventory? If YES, indicate the battery's nomenclature, e.g., BA-XXX, BB-XXX, etc.

30.1.48

Can the battery enclosure or box prevent injury or damage in the event of a violent gas venting or rupture of the battery cells?

30.1.49

Are battery compartments vented? (29 CFR 1910.178(g)(2))

30.2 Mechanical.

30.2.1

Are safety covers provided for exposed gears, cams, levers, fans, and belts?

30.2.2

Are self-lock or other fail-safe devices incorporated into expandable and collapsible structures, such as shelters, jacks, masts, and tripods, to prevent accidental or inadvertent collapsing or falling?

30.2.3

Are positive means provided to prevent mismating of fittings; couplings; fuel, oil, hydraulic, and pneumatic lines; and mechanical linkages?

30.2.4

Are doors and drawers and associated catches, hinges, supports, fasteners, and stops designed to prevent accidental injury?

30.2.5

Is the installed equipment free of overhanging edges and corners that may cause injuries?

30.2.6

Is the equipment likely to remain upright under normal use and in strong wind, considering its means of support and center of gravity?

30.2.7

Does the weight of the equipment that is designed to be carried by a single soldier not exceed the following limits?

Weight (lbs)

Handling Function	M&F	M
Equipment designed to be lifted from the floor to five feet or less above the floor.	37	56
Equipment designed to be lifted from the floor to three feet or less above the floor.	44	87
Equipment designed to be carried 33 feet or less.	42	82

Male and Female Population

Male Population Only

30.2.8

Does the weight distribution allow easy handling, moving, and positioning?

30.2.9

Are suitable carrying handles provided?

30.2.10

Are lifting requirements labeled on equipment weighing over 37 lbs?

30.2.11

Are safety of relief valves provided for pressurized systems or components?

30.2.12

Deleted

30.3 Environmental.

30.3.1

Is the temperature of all exposed parts less than 60^{o}C, when the ambient temperature is 25^{o}C, regardless of the condition of operation?

30.3.2

Is the temperature of front panels and operating controls less than 49^{o}C, when the ambient temperature is 25^{o}C, regardless of the condition of operation?

30.3.3

Is the release of toxic, corrosive, or explosive fumes or vapors prevented?

30.3.4

Are the outer coverings of cables, wires, and other components free of glass fiber materials?

30.4 Radiation.

30.4.1

Are warning labels provided that indicate the hazardous range of microwave emissions for components that produce a power density in excess of the following limits?

Frequency (f)	Power Density (MHz) mW/cm2
0.01-3	100
3-30	900/f2
30-100	1
100-1,000	100
1,000-300,000	10

30.4.2

Have all devices that exceed 10,000 volts been evaluated for X radiation?

30.4.3

Are X-ray producing devices shielded to reduce personnel exposure to 2.0 mr/hour or less?

30.4.4

Are X-ray producing devices and components in which they are located labeled with an X-radiation hazard warning symbol?

30.4.5

Have tests verified no radium or other radioactive materials are present?

30.4.6

Are all tubes, knobs, meters, dials, scales, markings, etc., free of radioactive material? If NO, indicate isotope and quantity.

30.4.7

Are radiation markings and labels affixed to all parts or components containing radioactive material?

30.4.8

Are filters, goggles, or other protective devices provided, and are warning signs posted, for all sources of radio frequency, ultraviolet, infrared, high-energy visible, laser, and any other type of hazardous radiant energy?

30.4.9

Is either an FDA classification label or a DA Label 168 affixed to each laser device?

30.5 Other Safety, Including Software Safety.

30.5.1

Are there provisions to prevent injury from implosion of cathode ray tubes?

30.5.2

Is equipment designed to prevent accidental ignition of hazardous atmospheres? (Applicable to equipment that is intended for use in atmospheres of explosive gas of vapors, combustible dusts, or ignitable fibers and flyings.) (NFPA 70-87 [550-2])

30.5.3

Is a shut-down device or an alarm provided to prevent injury or equipment damage?

30.5.4

Is there adequate separation between critical warning lights and other lights?

30.5.5

Are audible warning signals distinguishable from other sounds under normal operating conditions?

30.5.6

Are warning circuits separate from control circuits?

30.5.7

Is the display lighting of aircraft electronics (avionics) compatible to the use of night vision goggles

CLARIFICATION: QUESTIONS 30.5.8 THROUGH 30.5.16 PERTAIN TO SYSTEM SOFTWARE. SOFTWARE INCLUDES FIRMWARE. THE TERM HARDWARE INCLUDES THE SYSTEM OR EQUIPMENT AND ITS SUBSYSTEMS AND COMPONENTS

30.5.8

Is the system or equipment free of software that (a) could create a hazard, (b) controls hazardous processes or outputs, or (c) controls information upon which the operator must rely in order to make safe decisions? If YES, then skip questions 5.9 through 5.16.

30.5.9

Does the software adequately control all hazardous routines and outputs?

30.5.10

Does the software allow the operator to take control over the hardware at any time? If the answer is YES, then skip question 5.11.

30.5.11

Does the software allow the operator to take control over the hardware when hazardous routines or outputs are involved?

30.5.12

Will operator have information needed in order to make safe decisions without reliance upon information generated by the software? If YES, skip 5.13.

30.5.13

Is the probability that the software will fail to provide information needed by the operator in order to make safe decisions at an acceptably low level?

30.5.14

Is the probability that the software will induce a critical hazard at an acceptably low level?

30.5.15

Can the failure of any input or output device cause a critical hazard?

30.5.16

Does the system assume or revert to a safe state upon a power failure or upon the failure of any hardware component, such as the primary computer?

30.6 Antennas.

30.6.1

Are antenna terminals insulated to prevent RF burns?

30.6.2

Are antenna tips designed to prevent puncture wounds?

30.6.3

Are labels provided to warn against contact with overhead electrical lines?

30.6.4

Are lock-out devices provided for remotely-operated antennas?

30.6.5

Are safety latches provided that prevent unintended release of the guy cable?

30.6.6

Lightning Protection Adequacy (NFPA 70-87 [810-20, 810- 57]). IF mast is electrically continuous, treat it as the down conductor.

a. If antenna acts as an aerial terminal, conductivity must equal or better that of #8 AWG solid copper. If YES, skip b.

b. If antenna does not act as an aerial terminal, (e.g. dish antenna) does rod extend at least 6 inches above the antenna and meet criteria in a?

c. Is down conductor equivalent to #8 AWG solid copper with a minimum strand size of #17 AWG?

d. Are joints mechanically strong and corrosion resistant?

e. Is resistance of joint less than that of 2 ft. (.6m) of down conductor? [R=.002 ohms or less - negligible resistance]

f. Will the down conductor remain free of bends or kinks after repeated use?

g. Is down conductor straight as possible without any turns not less than 90ø with 8 inch radius in turn? (NFPA 78-13, 3- 12.5)

h. Is ground rod at least ½ inch in diameter, 8 ft. long, copper clad steel or equivalent? (NFPA 78-13, 3-16.1)

i. Is ground rod free of paint?

j. Does antenna mast configuration during erection, storage, take-down or operation prevent any component of the lightning protection system from mechanical damage or wear?

k. If mast is electrically continuous and is acting as the down conductor, is the ground stud adequate?

30.7 Vehicles, Shelters, Trailers, and Vans.

30.7.1

Is the vehicle weight properly distributed and is the vehicle laterally stable?

30.7.2

Has the vehicle road-worthiness testing? (e.g. Munson road test)

30.7.3

Are entries and exits free of obstructions?

30.7.4

Is an emergency exit provided and marked?

30.7.5

Are ladders, non-slip surfaces, and guardrails or chains provided for the shelter roof?

30.7.6

Do the entryway ladders or steps allow safe entrance and exit?

30.7.7

Are adequate instructions provided for placement of detached semi-trailers?

30.7.8

Are safety chains provided to prevent the trailer from detaching from the towing vehicle?

30.7.9

Are accessories secured or stowed to prevent damage when the vehicle is moving?

30.7.10

Will the lifting rings support the total weight of the shelter and the installed equipment?

30.7.11

Are ground rod and straps provided?

30.7.12

Is a ground stud provided at the power entry box?

30.7.13

Is the ground stud identified by a label or other marking?

B - Are the ground pins of the convenience outlets hard wired to the ground stud?

30.7.14

Are the ground pins of the convenience outlets hard wired to the ground stud? (MIL-STD-188-124A [5.1.1.2.5.3])

30.7.15

Are all outdoor receptacles connected to ground-fault circuit interrupters (GFCI's)? If YES, skip question 7.16.

30.7.16

Is the socket configuration of each outdoor receptacle that is not connected to a GFCI unique to its special application and unusable for other applications or as a convenience outlet?

30.7.17

Are all ground wire color coated green? (NFPA 70-87 [210- 5B; 400-23])

30.7.18

Has a test been conducted to determine the amount of leakage current on the grounding conductor? If YES, indicate the amount of current, in milli-amperes, that was measured. (NFPA 70- 87 [250-21])

30.7.19

Except for generators, are all grounds, including GFE, isolated from neutral?

30.7.20

Is the power ground wire connected to the ground stud?

30.7.21

Proper color coding on indicators? (White: Information; Amber: Caution; Red: Danger; Green: Power On.)

30.7.22

Are terminals, plugs, and other exposed parts that may exhibit over 70 volts (convenience outlets excluded), guarded against accidental contact during maintenance?

30.7.23

Are safety switches provided to disconnect remotely- located assemblies?

30.7.24

Does the floor surface prevent slipping? (29 CFR 1910.22a)

30.7.25

Are floor surfaces adequately insulated?

30.7.26

Are there fire hazards present?

30.7.27

Are fire extinguisher's accessible and located near exits? Are they of the proper rating for the application?

30.7.28

Are open hatches, covers, lids, and doors positively locked?

30.7.29

Are hinged or sliding components (except for the equipment rack shelf) latched or otherwise secured to prevent unintended movement?

30.7.30

Do the racks or cabinets contain stops to prevent drawers from extending beyond their intended limits?

30.7.31

Are fuel line that are inside the shelter made as short as possible?

30.7.32

Is there a heater fuel shut-off valve inside the shelter?

30.7.33

Is a fuel line or adapter provided for connection to the external fuel tank or container?

30.7.34

Is the heater exhaust pipe located as far as possible from the fuel intake valve?

30.7.35

Does the heater exhaust pipe routing prevent the concentration of carbon monoxide in the shelter?

30.7.36

Are fuel cans located outside the shelter and at a safe distance from the heater?

30.7.37

Are battery compartments forced-air ventilated to the outside?

30.7.38

Is a warning device provided to indicate when either the battery vent lid or door is closed or when the ventilation fan is inoperable?

30.7.39

Are warning labels provided to indicate possible explosive gas accumulations?

30.7.40

Is the vehicle exhaust sufficiently separated from shelter openings to avoid an accumulation of carbon monoxide in the shelter?

30.7.41

Is there adequate overhead clearance?

30.7.42

Are walls fastenings sufficient to prevent equipment from breaking away, falling, or accidently dislodging?

30.7.43

Are ceilings, walls, and other surfaces adjacent to aisles free of electrical switches that are vulnerable to breakage by accidental collision? If the answer is YES, then skip question 7.44.

30.7.44

Do such switches contain metal shafts that pose a hazard when exposed?

30.8 Health Hazards.

30.8.1

a. Are noise levels less than 85 dBA for steady state or 140 dBP for impulse? If your response is NO, answer question b.

b. Are appropriate warnings and/or safeguards provided on the equipment and in the technical manuals?

30.8.2

a. Are hazardous or potentially hazardous materials (e.g., toxics, flammables, ignitables, corrosives, reactives, explosives, oxidizers, carcinogens, etc.) used or required (operation, maintenance and/or storage)? (29 CFR 1910.1200). If your response is YES, answer questions b, c, 8.3, and 8.4.

b. Can non-hazardous materials be substituted?

30.8.3

Are potential exposures to hazardous materials during use, maintenance, and disposal controlled to levels below the Occupational Safety and Health Administration, (OSHA) Permissible Exposure Limit (PEL), American Conference of Governmental Industrial Hygienists (ACGIH), Threshold Limit Values (TLV), and/or National Institute of Occupational Safety and Health (NIOSH), Recommended Exposure Limits (REL), (use the most stringent standard)?

30.8.4

Is personal protective equipment (PPE) required for use of hazardous materials listed in 8.2.b

30.8.5

Is the shelter required to be occupied during normal operations?

30.8.6

Is the vehicle to be occupied during normal operations of the shelter?

30.8.7

a. Is the shelter air conditioned and/or heated to prevent heat and cold stress to occupants? (ACGIH TLVs, ANSI/HFS 100-1988D [5.8.1]). If your response is YES, answer question b.

b. Is the system's ECU sufficient to maintain temperatures within the shelter between 60-86oF?

30.8.8

a. Is lighting required within the shelter? If YES, answer question b.

b. Are light levels within the shelter sufficient to conduct normal operations?

30.8.9

a. Is the shelter powered by a generator, vehicle, etc. If your response is YES, answer question c.

b. Are personnel required to be in or near vehicles with generators operating and/or the vehicle engine idling during normal operating conditions? If your response is YES, answer question c.

c. Do the diesel exhaust levels within the shelter or vehicle exceed permissible limits of the following substances:

Substances	Permissible Limits (PPM)	
	8 Hr TWA	STEL
Carbon Monoxide	35	200
Formaldehyde	0.75	2
Sulfur Dioxide	2	5
Acrolein	0.1	0.3
Nitric Oxide	25	N/A
Nitrogen Dioxide	N/A	1

30.8.10

a. Is insulating material (e.g., asbestos, fibrous glass, mineral wool, polystyrene foam, polyurethane foam) added or incorporated into the shelter, vehicle, or equipment? If you response is YES, answer question b.

b. Are appropriate warnings and/or safeguards provided on the equipment and in the technical manuals?

30.8.11

a. Are ozone-depleting substances (e.g., CFC-11, CFC-12, CFC-113, CFC-114, CFC-115, HCFC-123, Halon 1211, Halon 1301, Halon 2402, Methyl Chloroform, Carbon Tetrachloride) required? (Clean Air Act). If your response is YES, answer questions b and c.

b. Are appropriate warnings and/or safeguards provided on the equipment and in the technical manuals.

Can substitute with an ozone depletion potential (OPD) of 0.05 or less be used?

APPENDIX F
SEMI-AUTOMATED FORCES (SAF)

10. SCOPE.

This appendix establishes the performance, design, and development requirements for the SAF Configuration Item. SAF provides CCTT the capability to supplement manned simulators with sufficient friendly and enemy forces to complete the battlefield inexpensively and efficiently. The behavior of the SAF units will be controlled by the SAF configuration item. The SAF units shall be capable of operating as independent elements or as supplements to manned simulators. The SAF units will be under limited operator control at the SAF workstations. The SAF software shall provide the SAF units behavior based on the operator's inputs from the workstations and will be indistinguishable from the manned simulators. This appendix forms a part of the Prime Item Development Specification for the CCTT 116852 and all of the design requirements of CCTT are applicable to SAF unless exceptions are made in this appendix.

10.1 Definitions.

The following definitions are applicable to this appendix.

a. Platform - The lowest level of SAF control (e.g. single vehicles, single aircraft, single weapons, dismounted infantry fireteam).

b. Unit - Any possible level of control (e.g. battalion, company, platoon, platform).

20. APPLICABLE DOCUMENTS.

FM 101-5-1 - Operational Terms and Symbols.

CCTT User Interface Style Guide

The following documents shall be used as initial design guidance for SAF:

CLASSIC SOVIET TACTICS (OPFOR):

FM 100-2-1 - The Soviet Army Operations and Tactics

FM 100-2-3 - The Soviet Army Troops, Organization and Equipment

US TACTICS AND DOCTRINE (BLUFOR):

FM 71-1 - Tank and Mechanized Infantry Company Team

FM 71-2 - The Tank and Mechanized Infantry Battalion Task Force

FM 17-15 - Tank Platoon

FM 17-57	-	Scout Platoon
FM 17-97	-	Regimental Armored Cavalry Troop
FM 17-95	-	Cavalry Operations
FM 7-91	-	Tactical Employment of Anti-Armor Platoons, Companies, and Battalions
FM 7-7J	-	The Mechanized Infantry Platoon and Squad
FM 101-10-1	-	Staff Officer Field Manual
FM 7-9	-	Tactical Employment of Mortars

30. Requirements.

30.1 SAF configuration.

This appendix divides SAF into the SAF Hardware Configuration Item (HWCI) and the SAF Computer Software Configuration Item (CSCI). Any reference to SAF shall assume the system created by the combination of both components. The complete set of SAF workstations shall have the capability of controlling both BLUFOR and OPFOR units in one to five exercises as defined in 3.2.1. A SAF workstation shall be required to control SAF units in only one exercise. A SAF workstation shall be required to control SAF units in only one force (i.e. BLUFOR or OPFOR).

30.1.1 SAF HWCI.

30.1.1.1 SAF workstation.

The SAF workstation shall provide a PVD display and a SAF control display to control and monitor the performance of the SAF units. The SAF workstation shall be designed to control up to a battalion task force (ie. up to 120 SAF platforms). As a Preplanned Product Improvement (P^3I), a SAF workstation shall support a regiment or brigade of SAF platforms.

30.1.1.1.1 Map display.

Each SAF workstation shall provide a map display of the gaming area. The SAF map display shall have a minimum size of 19 inches, measured diagonally across the display tube. The SAF map display shall be a high resolution color monitor (ie. 1024+ scanlines). The SAF map display shall be capable of displaying all terrain features, contour lines, unit location, unit movement, direct and indirect fire, and overlays.

Units displayed on the SAF map display shall be icons that represent standard symbology as defined in FM 101-5-1 Operational Terms and Symbols and, at the platform level, the operator shall be able to select an alternate top-down view icon of the platform. The operator shall be able to select the scale of the top-down view icon of platforms from a set of discrete scale choices.

The top-down view icon of a platform on the SAF map display shall change to show the platform's orientation, main weapon orientation, turret direction, and discrete damage levels. The operator shall be able to select FM 101-5-1 symbols on the SAF map display to be at the battalion, company, platoon or platform level.

The operator shall be able to identify an area on the map display to expand to cover the entire screen. The maximum area selected shall be the entire terrain map. The feature to expand any area of the SAF map display shall allow the operator to identify the area to be expanded. The SAF system shall allow an operator to specify a scale factor for drawing the map display with a maximum scale factor of the entire terrain map. The time for the SAF to draw or re-draw the map display shall not exceed fifteen seconds.

30.1.1.1.2 Displays.

SAF operators shall be able to interact with SAF displays through a combination of text entry and graphical interaction, as appropriate. The operator shall be able to view a display of events, changes of state, or reporting requirements that occur to units under that workstation's control. The SAF operator displays shall allow SAF exercise initiation and editing in conjunction with the map display.

30.1.1.1.3 Keyboard and input devices.

The SAF workstation shall provide a keyboard and mouse to permit operator response.

30.1.1.2 Network interface.

A network LAN interface meeting the CCTT LAN specification shall be provided for SAF use. The CCTT design must allow multiple SAF workstations to be placed on the LAN locally (or as a P3I on the Long Haul Network) subject to the network capabilities specified by the requirements of Section 3.7.4.1. The LAN interface shall be designed so that a single node loading will not overload the LAN operation.

30.1.1.3 Communications network.

To provide voice communication, two simulated radios shall be provided at each SAF workstation to interface with the CCTT voice communication system.

The communications system shall be configurable such that a SAF operator will have access to the communications nets to provide SAF control. Two separate simultaneous communications nets per SAF workstation shall be provided.

CCTT shall receive and respond to a Variable Message Format (VMF) Call for Fire Message. NOTE: Please refer to the Variable Message Format Technical Interface Design Plan, Test Edition, June 18, 1996, for VMF descriptions. CCTT shall receive and respond to a VMF End of Mission and Surveillance message when tactically appropriate. CCTT shall receive and respond to a VMF Message to Observer message when tactically appropriate. CCTT shall receive and respond to a VMF Obstacle Report. CCTT shall generate a VMF Message to Observer message. CCTT shall generate a VMF Spot/SALUTE message. CCTT shall generate a VMF Situation Report. CCTT shall generate a VMF Threat Warning message. CCTT shall transmit and receive VMF messages contained in DIS PDUs over the CCTT FDDI LAN.

CCTT shall generate a Variable Message Format (VMF) Call for Fire Message. CCTT shall generate a VMF End of Mission and Surveillance message. CCTT shall generate a VMF Check Fire message. CCTT shall generate a VMF On Call Fire Command message. CCTT shall generate a VMF Subsequent Adjust message. CCTT shall generate a VMF Observer Notification message. CCTT shall receive and respond to a VMF Check Fire message. CCTT shall receive and respond to a VMF Subsequent Adjust message.

CCTT shall generate a Variable Message Format (VMF) Observer Status message. CCTT shall generate a VMF Obstacle Report message. CCTT shall generate a Bridge Report message. CCTT shall generate a VMF Logistics Report message. CCTT shall receive and respond to Check Fire VMF messages. CCTT shall receive and respond to On-Call Fire Command VMF messages. CCTT shall receive and respond Oberver Notification VMF messages. CCTT shall receive and respond to Spot/SALUTE Report VMF messages. CCTT shall receive and respond to Threat Warning VMF messages. CCTT shall receive and respond to Bridge Report VMF messages. CCTT shall receive and respond to Strike Warning VMF messages. CCTT shall receive and respond to Situation Report VMF messages.

CCTT shall generate a VMF End of Mission and Surveillance message. CCTT shall generate a VMF Check Fire message. CCTT shall generate a VMF On Call fire command message. CCTT shall generate a VMF Subsequent Adjust Command message. CCTT shall generate a VMF Observer Notification message. CCTT shall receive and respond to a VMF Check Fire message. CCTT shall receive and respond to a VMF Subsequent Adjust message. CCTT shall generate a Variable Message Format (VMF) Call for Fire Message

CCTT shall generate a VMF Observer Status message. CCTT shall generate a VMF Bridge Report message. CCTT shall generate a VMF Obstacle Report message. CCTT shall receive and respond to a VMF Threat Warning message. CCTT shall receive and respond to a VMF Bridge Report message. CCTT shall receive and respond to a VMF Observer Status message. CCTT shall receive and respond to a VMF On Call Fire Command message. CCTT shall receive and respond to a VMF Observer Notification message. CCTT shall receive and respond to a VMF Situation Report message. CCTT shall receive and respond to a VMF Spot Report message.

30.1.1.4 Computer system.

Computer equipment shall be provided to support the following SAF hardware configurations:

2 SAF workstations for each mobile system (capable of supporting 1 exercise) and 10 SAF workstations for fixed sites (capable of supporting up to 5 exercises simultaneously).

A worst case processing load for all SAF capabilities at a fixed site shall be five SAF workstations each controlling a battalion task force of up to 120 SAF platforms (controlling a maximum of 600 platforms at a fixed site). A worst case processing load for all SAF capabilities at a mobile unit shall be a combined total of up to 120 SAF platforms using one or both SAF workstations.

The system shall support the expansion of the SAF workstation to control a regiment of SAF platforms (thru P3I).

30.1.1.4.1 Printer.

The SAF system shall have printers capable of generating hardcopies of the exercise overlays and PVD, as well as the units created by the SAF unit editor, in graphical form. SAF shall be able to share printers over the network. SAF shall have the capability to print exercise overlays and units.

30.1.1.4.2 Database storage capacity.

Although only one terrain database shall be in use (selected) for an exercise at any given time, the SAF shall have enough mass storage capacity to simultaneously accommodate three complete terrain databases; that is, the three deliverable training environments of 30.7.4.1 of Appendix A of the Prime Item Development Specification. The time required to load any one of the terrain databases which are available on a SAF workstation shall be less than 5 minutes. The SAF operator shall be able to replace one of the available terrain databases with a new compiled database from local storage in less than 1 hour.

30.1.1.5 Furniture and chairs.

The areas within the various CCTT installations that the SAF HWCI items will reside shall have the furniture, chairs and equipment racks provided to accommodate one SAF operator at each SAF workstation. Colors of the furniture, chairs, and equipment racks shall be specified by the Government. The chairs provided shall be upholstered in cloth, padded, have armrests and shall be provided with adjustable height and backrest, full swivel base, and swivel casters.

30.1.2 SAF CSCI.

This section describes the requirements of the SAF software.

30.1.2.1 SAF initialization.

The SAF initialization capability shall allow the operator to select and initialize units under SAF control. The SAF initialization capability shall coordinate with the Master Control Console (MCC) to support the central initialization of the CCTT system.

a. The SAF initialization capability shall provide password protection.

b. Using SAF initialization capability, the operator shall be able to create new SAF units, or select previously defined and stored SAF units for the CCTT exercise. Units can be at battalion, company, platoon, or platform level. The SAF initialization capability shall provide the facility to assign units to SAF workstations in the same exercise. During SAF initialization, the SAF operator shall have the capability to define a unit's initial location, initial formation and initial status (e.g., fuel, ammo, other logistical item levels, damage levels, and maintenance), based on those formations and attributes defined for SAF.

c. The SAF initialization capability shall be able to assign SAF units to the control of SAF workstations within a single exercise. Each SAF platform shall be assigned to a single SAF workstation.

d. The SAF initialization capability shall be able to recall and edit past exercise files that include the SAF unit task organization and exercise overlays.

e. The SAF initialization capability shall be able to delete or move previously assigned units.

f. The SAF initialization capability shall include a unit creation and edit tool (SAF unit editor). The SAF unit editor shall allow the operator to task organize units. The SAF initialization capability shall allow the SAF operator to save the created/edited units for future use from the SAF unit editor. Using the SAF unit editor, the operator shall be able to create units that have a mix of U.S. and non-U.S. platforms as defined in Appendix A, Table A-1. These units shall be emulated using either BLUFOR or OPFOR tactics, depending on the operator selected role for these units in an exercise. The SAF unit editor shall graphically display all units being created/edited using military-standard tactical unit symbols consistent with FM 101-5-1 Operational Terms and Symbols. The SAF unit editor capability shall allow the operator to edit, create, delete, archive, display, duplicate, label, print, retrieve, and edit the parameters of units that can be created by the SAF workstation.

g. The SAF initialization capability shall allow the operator to define a unit's marksmanship parameters, with possible settings of: marksman, competent, and novice. Each unit marksmanship setting shall have a parameter table that will define the platform's direct fire hit probability based on the range and target visibility. The parameter(s) shall also determine the time it takes for the SAF platform to perform target acquisition.

h. The SAF initialization capability shall be able to define the operational mode of the workstation when it assumes the Commander Mode as either Battlefield View or Commander's View.

i. During exercise initialization, SAF shall be able to accept and process terrain database selection and exercise parameters from the MCC. During exercise initialization, SAF shall be able to accept and process vehicle emplacement specifications from the MCC.

j. An overlay edit capability (SAF overlay editor) shall be provided by SAF that allows the operator to archive, create, delete, display, duplicate, edit, label, print, and retrieve overlays on a SAF workstation. The SAF operator shall be able to assign CISs to an overlay, position overlays, create and modify control measures, and create and modify instructions for SAF units associated with an overlay.

30.1.2.2 Commander mode.

The Commander Mode shall allow the operator to control units placed under the workstation's control during the SAF initialization mode.

30.1.2.2.1 Commander view submode.

The Commander's View submode of the Commander Mode shall limit the opposing units shown on the map display to only those units that can be seen and are detected by the platforms under the workstation's control. The Commander's View submode of the Commander Mode shall limit the intelligence gathering capabilities of the workstation's operator to the information that is gathered by the units under the workstation's control.

30.1.2.2.1.1 Battlefield view submode.

The Battlefield View submode of the Commander Mode displays all units belonging to the exercise controlled by the workstation on the workstation's map display. The Battlefield View submode of the Commander Mode shall provide the workstation operator access to entity information for each unit belonging to the exercise controlled by the workstation.

30.1.2.2.2 Task organization capability.

The SAF operator shall have a task organization capability to reorganize forces while in the Commander mode to deal with attrition and modified missions. The SAF operator shall be able to add new units, delete and teleport existing units to an exercise using password protected editing capabilites.

30.1.2.2.3 Overlay capability.

A SAF workstation operator in the Commander Mode shall be able to generate and modify overlays for units under its control.

An overlay in the Commander Mode shall be a series of graphic control measures on the map display that are constructed from points, lines, routes, areas, and zones.

a. In the Commander Mode, the SAF operator shall be able to attach instructions to an overlay for SAF units to report information to the SAF operator.

b. In the Commander Mode, The SAF operator shall be able to provide instructions to SAF units to change formation, platform spacing, speed, and altitude.

c. In the Commander Mode, the SAF operator shall be able to provide instructions to SAF units to dismount or remount infantry.

d. In the Commander Mode,the SAF operator shall be able to provide instructions to SAF units to execute a standardized set of tactical behaviors (Combat Instruction Set).

e. In the Commander Mode, the SAF operator shall be able to provide instructions to SAF units to execute an assigned Combat Instruction Set at a defined time on the Simulation Time Clock or upon reaching a specified control measure on its operational overlay.

f. In the Commander Mode, the SAF operator shall be able to provide instructions for a SAF unit to wait until another unit(s) has reached a defined terrain feature or control measure before it executes an assigned task. An operator in the Commander Mode shall be able to modify overlays and tactical instructions (CIS) any time during a CCTT exercise by selecting from a predefined list of alternatives appropriate for the context. The operator in the Commander Mode shall be able to save the overlays at any time during the CCTT exercise for use in future exercises.

In the Commander Mode, the SAF operator shall be able to interface with the TOC, CSS, CES, FSE, FABTOC, UMCP, FDC, and TACP consoles to coordinate logistical, engineering, artillery and close air support for the BLUFOR units under SAF control. SAF and OC workstations shall be able to share overlays electronically over a network. In the Commander Mode, the SAF workstation shall allow the operator to control BLUFOR logistical, engineering, artillery and close air support units for only platoon level exercises and only when the OC cannot be manned.

In the Commander Mode, the SAF operator shall be able to generate overlays to control OPFOR logistical and engineering platforms to provide OPFOR logistical and combat engineering support.

In the Commander Mode, the SAF operator shall be able to generate overlays to provide OPFOR artillery support. In the Commander Mode, the SAF operator shall be able to control and generate overlays for OPFOR fire support platforms consistent with the deployment of a Threat Regimental Artillery Group (RAG) and supporting elements of the Division Artillery Group (DAG).

In the Commander Mode, the SAF operator shall be able to control and generate overlays for BLUFOR and OPFOR fixed and rotary wing platforms. In the Commander Mode, the aviation operation overlays shall support: attack, CAS, and airmobile.

In the Commander Mode, the SAF operator shall be able to control and generate overlays for both BLUFOR and OPFOR air defense units.

The SAF Commander Mode shall be designed to provide overlay generation and modification user interfaces in accordance with the CCTT UI Style Guide.

The Commander Mode shall provide a peripheral device such as drawing with a mouse, graphics tablet or a light pen.

Vehicles dispatched by SAF to conduct OPFOR logistics and supply operations shall travel to the designated locations utilizing designated routes unless otherwise directed by the SAF operator. Vehicles dispatched by SAF to conduct OPFOR logistics and supply operations shall resupply the requesting vehicle or dismounted element if within a 200 meter radius from the designated resupply point. After the OPFOR vehicle requesting resupply is serviced or is not at the designated resupply point when the resupply vehicle arrives, all other vehicles (if any) within the 200 meter radius shall be serviced.

The aviation platforms controlled by SAF shall perform evasive actions for self protection.

30.1.2.2.4 Combat Instruction Set (CIS).

CISs shall be provided to control the behaviors of battalion, company, platoon, and platform level units. CISs shall be provided to control the behaviors of the standard BLUFOR and OPFOR units that are composed of vehicles defined in Table A-1 and organized according to the Army SOP used to define CCTT training. CISs shall be capable of controlling the behaviors of the operator created BLUFOR and OPFOR mixed units that are composed of vehicles defined in Table A-1 and organized to emulate either BLUFOR tactics or OPFOR tactics as selected by the operator. CISs shall have a syntax and structure that is both explicit and organized to reflect US and Soviet/Russian tactical doctrines. The explicit format for the operator’s selection and instantiation of CISs shall not be a procedural design language, program design language, or any syntax or structure that requires computer programming skills or knowledge to understand the tactical doctrine being represented by the CISs.

SSS shall meet the following requirements:

a. The SSS shall simulate the movement dynamics of platforms under SAF control. The SSS shall provide movement PDU updates according to I.E.E.E.-1278. The SSS shall selectively update the position of each platform on the map display based on the physical displacement of that dynamic object relative to the size of the gaming area currently displayed. The SSS shall evaluate the CIS and overlays a unit is currently utilizing in determining the unit's movement dynamics. The SSS shall implement static and moving obstacle collision avoidance to make units under SAF control appear to operate in accordance with the Army Tactical Doctrine applicable to CCTT training. The SSS shall implement formation change heuristics to make units under SAF control appear to operate in accordance with the Army Tactical Doctrine applicable to CCTT training. When the operator places a unit's route on terrain that does not allow passage of that unit because of the terrain's trafficability characteristics, an alert will be generated on the operator's displays.

b. SSS shall simulate the damage of direct and indirect fire on the units under SAF control based upon the ballistics and damage calculations of 3.6.6 and 3.6.1.1. The SSS shall determine the SAF unit's target priorities and simulate the units direct and indirect fire. The SSS shall interface with the LAN per the CCTT specification to exchange direct and indirect fire information with the other simulators. Direct and indirect fire shall be displayed on the SAF map display. A Platform's direct and indirect fire hits shall modify the platform's appearance on the SAF map display to show the type and amount of damage at discrete levels. The SSS shall modify the platform's performance capabilities based on the damage sustained. The SSS shall generate alerts to the workstation controlling a platform which is either performing or being attacked by direct or indirect fire. The SSS shall reevaluate the CISs of the units attacked by direct or indirect fire and modify the units' behaviors to determine actions the unit should take after itself or a supporting unit has sustained damage or casualties. The SSS shall use the CISs of the SAF unit to determine the unit's target priorities, counter measures and engagement criteria. The unit's assigned marksmanship parameter(s) shall be utilized in determining the platform's direct fire capabilities.

c. The SSS shall simulate logistical effects on units under SAF control. When a unit becomes low on the logistical elements it needs to operate (i.e. ammo, fuel), an alert will be generated on the display of the SAF workstation controlling the unit. The SSS shall use the CISs of the unit low on logistical elements to determine and execute the actions the unit should take.

d. The SSS shall be able to perform a detection and intervisibility check for units under SAF control. The workstation operator shall be able to select a unit under SAF control on the Map display and have the unit's area of visibility highlighted. The SSS shall determine the platform's behaviors upon the detection of an enemy platform according to the platform's current CIS.

e. The SSS shall monitor and analyze the actions of individual detected opposing platforms. The SSS shall utilize the unit's CISs to determine the reactions the SAF unit shall take in response to the opposing unit's individual detected actions. The SSS shall be able to change the SAF unit's operating CIS in response to the individual detected actions of the opposing units.

f. The SSS shall provide the SAF operator the capability of monitoring and overriding the currently selected unit's CIS (e.g. FRAGOs). The operator shall have the ability to select alternative control measures associated with the current overlay. The SSS shall provide a facility for the operator to monitor and modify unit behaviors and parameters of a selected unit in accordance with the CCTT UI Style Guide. SAF shall not allow modification of unit behaviors and parameters that violate the unit's physical constraints as implemented by the SAF vehicle models.

g. The operator shall be able to request the status (i.e., strength, ammo, fuel, damage) of units under the SAF workstation's control. The workstation operator shall be able to selectively filter the alerts that are displayed by specifying a particular alert level and type for each unit.

h. The SSS and CISs shall be designed to provide a Command From a Simulator (CFS) mode for BLUFOR units. In the CFS Mode, the SAF shall control the tethered units which will move and shoot as adjacent, forward, and rear elements to the manned simulator platform. The communications network shall allow the manned simulators to communicate with the SAF workstation operator to coordinate the CFS mode.

i. deleted

j. The visibility performance of SAF units shall be affected by environmental conditions defined for the system which are weather (that is clouds, fog, rain, and haze) and time of day (in predetermined discrete increments). The SAF vehicle modeling (speed and formation spacing) shall take into account the effect of visibility limitations due to environmental conditions defined for the system which are weather (that is clouds, fog, rain, and haze) and time of day. Haze shall effect the SAF visual emulation from a distance of zero meters to the maximum target visible range implemented by the visual system (currently 4 km visibility) in increments of 0.5 km or less as defined for the system. The effect of fog on the SAF visual emulation shall be proportional to the line of sight range through the fog to the detected entity. The SAF visual emulation shall take into account the effect of rain as defined for the system. The SAF visual emulation shall take into account the effects of complete cloud layers (i.e., 100% overcast) defined for the system at a specific altitude. The SAF visual emulation of line of sight and vehicle detection shall be enhanced by the effects of flare illumination. The SAF visual emulation of line of sight and vehicle detection shall be degraded by the effects of deployed tactical smoke. Laser range finder effects shall be embedded in weapon system characteristic data and engagement effectiveness estimates. The SAF representation of fixed selectable features shall include height changes for buildings and elimination of span for bridges and overpasses only when in the destroyed state. The SAF representation of and reaction to relocatable objects shall reflect the operational objectives of the relocatable object (for example, tank ditches will impede motion and defilade positions will block line of sight and munitions). SAF ground vehicles shall follow the contour of the terrain (stay on the ground). The SAF line of sight computation shall take into account the effect of obscurance by terrain features and terrain surface type. SAF vehicle modeling shall take into account the effects of particular surface characteristics such as speed effects on platforms caused by soil type, effects on trafficability by water depths, terrain slope, and collision conditions defined by terrain objects. SAF collision avoidance and collision detection shall account for the collision volumes associated with each entity and solid terrain feature. SAF collision avoidance and collision detection shall ignore terrain features that are not solid (e.g. small bushes). The SAF visual emulation shall take into account the effect of magnification, thermal imagery system, light intensification, and other sensor devices explicitly associated with the platform types defined in Appendix A, Table A-1. The line of sight cut-off distance for SAF platforms shall be consistent with that used by the visual system (currently 4 kilometers). The visual performance of SAF units detecting other platforms shall account for the visual system's lighting effects that simulate ground and air traffic. Dust trails in daylight conditions shall be generated by SAF controlled ground vehicles when and only when traversing dry dirt or sand areas. The effects of vehicle type, direction of movement (forward and reverse), vehicle speed, and dust trail size (small, medium, and large) shall be included in the dust trail simulation. SAF controlled ground vehicles shall be able to maneuver under overpasses and bridges that provide physical dimensions allowing trafficability. Overpasses and bridges shall provide line of sight and munition blockage. SAF vehicle movement through the database shall be unrestricted except where the restriction is consistent with the operation of the manned vehicles (e.g., a heavy vehicle will not able to maneuver within a thickly forested area). SAF vehicles shall be able to utilize a wooded area for concealment when the wooded area is trafficable by that vehicle. The ability of the SAF visual emulation to detect vehicles using a wooded area for concealment shall be degraded by the wooded area.

k. As part of the reset activity, SAF shall be able to accept exercise setup parameters and entity emplacement information from the network in order to aid the SAF operator during the reset process. To support the reset capability, SAF shall store information necessary to automatically reset all values and parameters in SAF to the specified time and then continue the exercise.

l. SAF shall model the stochastic failures, as defined in 3.6.1.2, for only those BLUFOR ground vehicles that will be maintained under the direction of the Battalion Maintenance Officer.

m. SAF shall represent a DI platform on the CCTT network as a single DI entity.

30.1.2.2.6 SAF platforms.

The SAF simulation software shall be designed to simulate the BLUFOR and OPFOR vehicles, aircraft, dismounted infantry and weapon systems of Appendix A, Table A-1. BLUFOR simulation shall be in a tactically realistic manner as defined by standards of the ARTEPs and associated training references applicable to CCTT training. OPFOR shall be portrayed in a tactically realistic manner as defined by appropriate Soviet/Russian tactical reference documents and those field manuals and publications specified by CAC-THREATS. CISs will provide the SAF operator the ability to direct units assigned to the control of the operator’s SAF workstation in tactical situations for CCTT training. CIS’s shall be designed for units composed of the following platforms:

a. BLUFOR

(1) All NON-Soviet/Russian platforms in Appendix A, Table A-1.

b. OPFOR

(1) All Soviet/Russian platforms in Appendix A, Table A-1.

30.1.2.2.7 SAF CIS and Parameter Custom Editor (s).

The SAF shall provide off-line programming utilities to create and modify CIS and SAF Parameters via high level specifications. The off-line programming utilities to create and modify CIS and SAF parameters shall convert the data into the internal format usable by the SSS. The off-line programming utilities to create and modify CIS and SAF parameters shall be designed to provide configuration control and security (via password control) for the CISs and parameters in accordance with the Automated Configuration Management Tool (ACMT) requirements of the CCTT Specification and Work Statement.

a. The off-line SAF CIS programming capability shall be able to modify CISs to specialize them for new exercises.

b. The off-line SAF CIS programming capability shall be able to create new CISs and modify existing ones to accommodate new tactics and doctrine.

c. The off-line SAF CIS programming capability shall be designed for user friendliness allowing user generation and modification of CISs. The off-line SAF CIS programming capability shall aid in CIS generation and modification by limiting parameter choices to those supported by the SSS. Each parameter choice supplied by the user of the off-line SAF CIS programming capability shall be checked for syntactic correctness and internal logical consistency with other SAF parameters.

d. The off-line SAF Parameter Editor shall be able to modify and create the following parameters that reflect the combat effectiveness of the force: marksmanship parameters, detection probabilities, direct fire hit probabilities, target acquisition times, indirect fire damage probabilities, and weapon system performance parameters (e.g., ranges, speeds, fire rates).

e. The off-line SAF Parameter Editor shall permit editing and modification of numeric data using both a graphical (e.g. curve drawing tools) and tabular form.

f. A CIS edit capability shall be provided by SAF that allows the operator to edit, create, archive, compile, delete, display, duplicate, label, print, and retrieve CISs on a SAF workstation.

30.1.3 Not Used.

30.1.4 SAF database tools.

Off-line terrain database tools shall be provided to extract the required data from the CCTT databases and format the data into the SAF terrain database. The SSS shall operate with any database generated by the SAF terrain database tools without requiring modification to the SSS.

APPENDIX G
M113A3 APC MANNED MODULE

10. Scope.

This appendix establishes requirements for the M113A3 Armored Personnel Carrier (APC) manned module.

20. Applicable Documents.

(This section is not applicable to this appendix.)

30. Requirements.

30.1 M113A3 APC simulator module.

The APC simulator shall be designed to replicate the performance characteristics of the M113A3, full tracked armored personnel carrier and associated systems as described in 30.1.1 through 30.1.2.3. The M113A3 shall be capable of mounting and dismounting an infantry unit in the visual database.

30.1.1 Performance characteristics.

The following paragraphs contain the minimum detailed performance requirements that shall be provided with the M113A3 manned module. The M113A3 manned module shall also meet the generic design requirements of paragraph 3.6.

30.1.1.1 Deleted.

30.1.1.2 Vehicle weapon systems.

The vehicle weapons system for the M113A3 manned module shall have the capability for target sighting, aiming and firing of the M2 .50 Cal. Machine Gun and M257 Smoke Grenade Launcher. The simulated vehicle weapons system components shall replicate the operational equipment in both design and performance. The vehicle weapons system shall consist of:

a. M2 .50 Cal. Machine Gun.

b. M257 Smoke Grenade Launcher.

These components in combination with the other simulated systems in the M113A3 simulation system shall provide the crew the capability to engage targets from a stationary position with a precision that matches real world results.

30.1.1.3 M113A3 APC weapons ammunition.

30.1.1.3.1 M113A3 APC Ammunition.

The M113A3 simulation system shall simulate the following vehicle weapons and ammunition:

a. M2 .50 Cal. Machine Gun, (A534 API-T).

b. M257 Smoke Grenade Launcher System (Smoke Grenade Arming Firing Unit) using the L8A3 RP smoke grenades.

30.1.1.3.2 M113A3 APC DI Stowed Ammunition.

The M113A3 simulation system shall stow the following ammunition for DI battlefield resupply:

a. Javelin and/or Dragon Anti-Tank Missile.

b. AT-4 (84mm, M136).

c. 5.56mm Ball & linked Tracer (A064)

d. 5.56mm Ball (M855), Tracer (M856)

e. 40mm Grenade (M433 single grenades)

f. 7.62mm Machine Gun A141, Ball, Tracer

g. Claymore Anti-personnel mines (M18), Anti-personnel mines (M16A1), and Anti-Tank (M21) mines.

30.1.1.4 Support Systems.

30.1.1.4.1 Electrical System.

The electrical system shall be capable of the following operating states:

a. Engine off, master power off.

b. Engine off, master power on.

c. Engine running, alternator working.

d. Engine running, alternator not working.

Based on the operating state the electrical system is in, the associated problems and abilities shall be reflected in the M113A3 simulation system. The problems and abilities shall be replicated in the M113A3 simulation system just as they would occur in the operational equipment.

30.1.1.4.2 Hydraulic System.

The ramp hydraulic pump shall be virtual (no physical ramp). The operation of the ramp hydraulic pump shall be simulated. The ramp hydraulic pump shall provide simulated hydraulic pressure for raising and lowering the virtual M113A3 ramp.

30.1.1.5 Depletable resource management.

Depletable resource management shall cover the management, consumption, and resupply of both fuel and ammunition. The fuel for the M113A3 manned module shall be based on the fuel contained in the M113A3's fuel tanks. The resupply of fuel shall be accomplished through coordination with the ALOC and shall occur with the use of a fuel carrier. The maximum ammunition capacity for the M113A3 simulation system shall be based on the internal storage capabilities of the actual M113A3 for the weapons identified in 30.1.1.3. The identification, transfer, and resupply of ammunition shall be the responsibility of the vehicle commander. The resupply of all ammunition shall be coordinated through the ALOC. In all cases, the monitoring of, use of, and resupplying of the M113A3's fuel and ammunition shall be based on the implementation of representative time and depletion parameters. The Resupply Operations shall include:

a. Simulated Transfer of:

(1) Fuel from a fuel carrier to the M113A3

(2) Fuel from a fuel pre-stock to the M113A3

(3) Ammunition from an ammunition truck,

(4) Ammunition from another M113A3

(5) Ammunition from another manned module with comparable ammunition stocks

(6) Ammunition from prepositioned ammunition stocks

b. Reload times for the weapons listed in paragraph 30.1.1.3.

c. Depletion rates.

(1) Fuel available related to M113A3 consumption rate.

(2) Ammunition basic allowance for the various weapons listed in 30.1.1.3.

30.1.1.6 Damage and Failure.

The list of components that are modeled for combat damage stochastic failure, and deterministic failures shall be as defined in Table G-I.

Table G-I. M113A3 Failures and Damage

Component/System	Deterministic	Stochastic	Combat Damage
Air Filter		X	
Alternator		X	X
Antenna			X
Batteries		X	X
Bilge Pump		X	X
Commander			X
Driver			X
Drown	X		
Engine Assembly			X

Table G-I. M113A3 Failures and Damage			
Component/System	**Deterministic**	**Stochastic**	**Combat Damage**
Engine Cooling System		X	X
Engine Oil System		X	X
Engine Starter		X	X
Fuel Filter		X	
Intercom		X	X
Left Idler Wheel			X
Left Roadwheel 1			X
Left Roadwheel 2			X
Left Roadwheel 3			X
Left Roadwheel 4			X
Left Roadwheel 5			X
Left Sprocket			X
Left Track	X	X	X
Machine Gun Inoperative		X	X
PLGR	X		
Radio A		X	X
Right Idler Wheel			X
Right Roadwheel 1			X
Right Roadwheel 2			X
Right Roadwheel 3			X
Right Roadwheel 4			X
Right Roadwheel 5			X
Right Sprocket			X
Right Track	X	X	X
Rollover	X		
Service Brake		X	
Transmission Assembly		X	X
Transmission Oil Filter		X	

30.1.1.7 Sound generation system.

A sound and acoustic vibration generation system shall be provided. The sound system shall be completely separate from the communication system, and the sounds and vibrations shall be presented independently from any headphone system (i.e. multiple loudspeakers). The sounds and vibrations shall be of such fidelity, quality, realism, and volume that crew members shall experience the cues, stresses, and distractions of a "real

life" combat situation. The sounds shall be of sufficient volume so that the distractions provided to the crew members shall equal that found in an actual situation, but in no case shall 95 dB be exceeded for steady state noise (measured external to the CVC helmet). Table G-II lists the sound cues that shall be provided in the M1A1 simulation system.

Table G-II. M11A3 SOUND CUES

SOUND CUE
Engine start to idle
Engine noise related to Revolutions Per Minute (RPM)
Engine idle to stop
Starter
Transmission noise related to RPM
Collisions with objects (scraping and hard collisions)
Track noise - related to speed for terrain types simulated in CCTT
Track popping (about to be thrown)
Horn
Fuel Transfer pump
Bilge pumps
Ramp lock
Ramp unlock
Lowering ramp - begin
Lowering ramp - continuous
Lowering ramp - end
Raising ramp - begin
Raising ramp - continuous
Raising ramp - end
Fire M2 .50 Caliber Machine Gun
Fire M257 Smoke Grenade Launcher
Friendly and hostile main gun fire
Friendly and hostile missile launch
Friendly/hostile machine rocket launch
Generic explosive round (main gun, missile, rocket) hit
Generic explosive round (main gun, missile, rocket) miss
Generic kinetic round hit
Friendly and hostile machine gun fire - large caliber
Friendly and hostile machine gun fire - small caliber

Table G-II. M11A3 SOUND CUES
SOUND CUE
Friendly and hostile mine hit
Friendly and hostile bomb hit
Friendly and hostile bomb miss
Friendly and hostile artillery hit
Friendly and hostile artillery miss
Wheeled vehicle - large class
Wheeled vehicle - small class
Tracked vehicle
Aircraft - rotary wing class
Aircraft - fixed wing class

30.1.1.7.1 Sound synchronization.

The sound system shall be synchronized with the visual displays and the M113A3 controls within the system latency requirements, as defined in paragraph 3.2.2.1, and within the module latency requirements, as defined in paragraph 3.2.2.2.

30.1.1.7.2 Sound generator.

During real-time operation, the desired sounds shall be stored in the sound system and shall be available in real-time to the vehicle simulator. The system shall provide outputs for driving speakers and subwoofers. The sound generation system shall have the ability of generating a minimum of eight sounds simultaneously with full parametric control offrequency and volume. Where appropriate, sound generation channels shall be "shared" by several different sounds on a priority basis. The number of sound generation channels shall be expandable to allow for future needs that may require the capability to generate a larger number of sounds simultaneously.

30.1.1.7.3 Storage.

The M113A3 simulation system shall have the capacity to store all sound data and shall be expandable to allow for future increases in storage that would be necessary to generate a larger base of sound data.

30.1.1.7.4 Spatial positioning.

The sounds shall be synchronized with the actions causing the sounds and shall be presented to allow personnel the ability to identify the distance (amplitude and time delay) of the events causing the sounds.

30.1.1.7.5 Audio amplifiers.

The audio amplifiers shall be of sufficient quality and power-handling ability to recreate the required volume levels without distortion greater than 0.05 percent Total Harmonic Distortion (THD) over the dynamic range.

30.1.1.7.6 Speakers.

Audio cues shall be presented via speakers contained in the manned module crew compartment. The speaker configuration for each manned module shall be as defined in Table G-III. Headphones shall not be required to present the ambient "sounds of battle." Vibration cues (e.g. vehicle vibrations, weapons fire, and vibrations from explosions) shall be presented to the crew members through the use of subwoofers. Speaker placement within the module shall support spatial positioning.

Table G-III. M113A3 Module Speaker Arrangement

MODULE TYPE	SPEAKER	SEAT SPEAKER	SUBWOOFER
M113A3 APC	4	2	1

30.1.1.7.7 Sound quality.

The sound generator shall provide a frequency range of 25 Hertz (Hz) +/- 5 Hz to a minimum of 12,000 Hz. The audio amplifiers shall provide a frequency range of 25 (Hz) +/- 5 Hz to a minimum of 20,0000 Hz. The combined signal to noise ratio of the sound generator and audio amplifiers shall be a minimum of 70 dB. The combination of speaker types shall provide a composite frequency response of 25 Hz to 20,000 Hz +/- 10 dB (after each speaker has been independently referenced to 0 dB).

30.1.1.8 Communication system.

A communication system shall be provided to the M113A3 manned module as described in section 3.7.6 of this specification.

30.1.1.9 Visual display system (MANPRINT).

The M113A3 visual requirements are stated in Appendix A.

30.1.2 Physical characteristics.

The following paragraphs contain the detailed physical requirements for the individual crew stations within each M113A3 simulator system. The M113A3 crew compartment shall exist as a consolidated enclosure for the driver's station, and commander's station. The crew stations shall be located relative to each other as they are in the actual vehicle. Each crew station shall include a seat replicating the respective seat found in the operational M113A3 vehicle. The M113A3 modules shall provide the controls, switches, indicators and space constraints described below:

30.1.2.1 Drivers station.

The following buttons, controls, gauges, lights, and switches shall be provided at the driver's station in the locations and panels as found in the actual M113A3.

a . MASTER SWITCH panel shall contain an operational master power switch and 3 dimensional dummy components:

(1) MASTER SWITCH shall be a three position pull to turn rotary switch which shall turn carrier electrical power on or off.

(2) Utility outlet shall be a full size mockup of the real connector and shall be operational but nonfunctional.

(3) Auxiliary power receptacle shall be a full size mockup of the real connector and shall be operational but nonfunctional.

(4) Deleted

b. Driver’s instrument panel shall be simulated and shall contain the following active switches and indicators.

(1) START switch shall be a momentary pushbutton which shall engage the engine starter.

(2) BATTery GENerator INDICATOR shall be a functional gauge which shall indicate battery and generator conditions as follows:

Left red zone: Indicates low battery charge with engine off.

Yellow zone: Indicates normal battery voltage with engine off. Indicates generator not charging with engine running.

Green zone: Indicates generator charging normally with engine running.

Right red zone: Indicates generator overcharging with engine running.

(3) FUEL TANK switch shall be a two position toggle switch which allows driver to read fuel level in LEFT and RIGHT external fuel tanks.

(4) FUEL LEVEL indicator shall be a meter assembly with the following positions (E, ¼, ½, ¾, F) which shall indicate level of fuel in LEFT and RIGHT external fuel tanks as selected using the FUEL TANK switch.

(5) Light switch assembly shall be simulated and fully functional.

(a) Panel light switch shall be a four position rotary switch which shall control the panel lights as follows

PANEL BRT position: Panel lights are brightly litOFF position: Panel lights are off.

DIM position: Panel lights are dimly lit.

PARK position: Stop lights and tail lights are lit.

(b) Lights UNLOCK switch shall be a spring-loaded, two-position lever. When held in the UNLOCK position, this lever will allow Driving Lights switch to be moved from BO MARKER to BO DRIVE, from OFF to STOP LIGHTS, and from STOP LIGHTS TO SERVICE DRIVE. The lever shall return to the locked position when released.

(c) Driving lights/main lights switch shall be a five position rotary switch which shall control exterior lights as follows:

B.O. DRIVE position: Enables the I.R. - B.O. SELECT switch to choose either infrared (non-functional) or blackout mode (functional) for night driving.

B.O. MARKER position: Blackout marker lights are lit. Blackout stoplight lights when brakes are applied.

OFF position: All exterior lights are off.

STOPLIGHT position: Stoplight lights when brakes are applied.

SERvice DRIVE position: Service headlights and taillights are lit. Stoplight lights when brakes are applied.

(6) Speed/Odometer shall be an active gauge and an active 6 digit display. The speed gauge shall represent the carrier speed in miles per hour, and the odometer shall indicate total carrier distance traveled in miles.

(7) MASTER SWITCH ON indicator shall be a red colored indicator which shall come on when the Master Switch is in the ON position.

(8) Engine coolant TEMPerature indicator shall be a functional gauge which shall indicate the engine operating temperature in degrees Fahrenheit.

(9) RPM HUNDREDS gauge (tachometer) shall be a functional gauge indicating the engine speed in revolutions per minute(RPM). The engine hour meter shall be a six digit inactive display.

(10) TRANSmission FILTER CLOGGED warning light shall be a red colored indicator which shall come on when the transmission filter is clogged and the engine is running.

(11) PARKING BRAKE indicator light shall be a red colored indicator which shall come on when the parking brake is set.

(12) Instrument panel lights shall be two RED colored indicators which are controlled by the panel lights switch.

(13) I.R. POWER switch shall be a two position toggle switch which shall be operational but nonfunctional.

(14) I.R.-B.O. SELECT switch shall be a two position toggle switch which shall be functional only in the BO position.

(15) AIR BOX HEATER switch shall be operational but nonfunctional.

(16) BILGE PUMPS switch(FRONT and REAR) shall be a two position toggle switch which shall turn front and rear bilge pumps on and off.

(17) BILGE PUMPS lights shall be two red colored indicators which shall light when the BILGE PUMPS switch is moved to the ON position.

(18) HEADLIGHTS HI BEAM indicator light shall be a red colored indicator which shall light when headlight high beams are on.

(19) TRANSmission OIL LOW PRESSure warning light shall be a red colored indicator which shall come on when the transmission oil pressure is low.

c. Driver's Front Warning Light Panel shall be simulated and contain the following switches and indicators:

(1) ENGINE COOLANT LOW LEVEL warning light shall be a red colored indicator which shall come on when the coolant level is too low for safe operation.

(2) TRANS OIL - HI TEMP warning light shall be a red colored indicator which shall come on when the transmission oil temperature is too high for safe operation.

(3) ENGINE OIL - LOW PRESSure warning light shall be a red colored indicator which shall come on when the oil pressure is too low for safe operation. Light shall go off 10 +/- 1 seconds after engine starts.

(4) STEERING LOCKED indicator light shall be a red colored indicator which shall come on when steering wheel is locked in center position.

(5) HORN Button shall be a pushbutton which shall sound the carrier horn which shall only be audible in the M113 Manned Module.

d. Intercom switch box shall be capable of selecting both intercom and radio channel through the use of the MONITOR switch, a 5 position rotary switch. The intercom volume shall be controlled through the VOLUME knob which shall be functional. The intercom panel shall contain two jacks to allow connection of a real CVC helmet to the intercom system.

e. Steering wheel shall be a functional assembly and when rotated shall provide the range of motion of the M113A3 steering wheel assembly. Deflections of the steering wheel from the center position shall cause the carrier to turn. Clockwise deflection(as viewed from above) shall cause the carrier to turn to the right. Counterclockwise deflection shall cause the carrier to turn to the left. Steering control deadband shall be 10 degrees +/- 5 degrees. Amount of travel of the steering wheel assembly shall be 60 degrees +/- 9 degrees. Breakaway force of the steering mechanism shall be 4.0 pounds +/- 2.5 pounds. Ending force shall be 24.0 pounds +/- 4.0 pounds. Specified breakaway and ending forces shall apply to deflection in either direction.

f. Fuel cutoff control shall be a two position handle assembly that when pulled shall stop fuel flow and when pushed in shall start fuel flow to the engine. The force required for handle movement shall be constant force of 20.0 pounds +/- 4.0 pounds. The travel distance for handle movement shall be 1.25 inches +/- 0.5 inches.

g. Transmission controller shall be a seven position lever assembly that selects the driving range of the carrier automatic transmission. The SL (steering lock) position shall lock the steering wheel in the center position. This position shall be used during starting, idling, and engine shut down. The R(reverse) position shall be used for backing the carrier on land and in the water. The PV(pivot carrier) position shall be used to turn the carrier on its own center. The 1-4 position shall be used to drive the carrier in normal forward operation. The 1-3 position shall be used when climbing and going down slight grades, driving cross country at high speeds, and driving on roads at moderate speeds. The 1-2 position shall be used when climbing and going down medium grades, driving cross country at slow speeds, and while in the water. The 1 position shall be used when climbing and going down steep grades, and when entering and leaving the water. This range shall provide maximum traction, low speed maneuvering, and engine braking. The transmission controller shall be actual equipment.

h. Accelerator pedal upper and lower shall be simulated as follows:

(1) Upper accelerator pedal shall be operational and functional.

(2) Lower accelerator pedal shall be a functional assembly that when operated shall control engine speed. The force required for pedal movement shall be 8.0 pounds +/- 2.0 pounds breakaway and 22.0 pounds +/- 4.0 pounds ending. The travel distance for pedal movement shall be 2.0 inches +/- 0.5 inches at the center of the pedal.

i. Driver's Periscopes - Four vision blocks (periscopes) shall be provided to the driver and shall display scenes generated by the visual system as specified in Appendix A.

j. Dome light shall be simulated and fully functional. The panel shall have a three position rotary switch which selects blackout or white light. The switch shall have a spring loaded, mechanical only, release button which shall prevent motion from blackout to white, by using a physical block, until button is pressed allowing traversal. The panel shall contain a blackout light and a white light. The dome light shall be located on the left side of the carrier near the driver.

k. Ramp actuating handle shall be fully simulated by the following components:

(1) Ramp locking handle shall be a two position lever assembly that when operated simulates locking the ramp in the raised position and unlocking the ramp for lowering. The force required for handle movement shall be 4.5 lbs. +/- 1.0 lb. for opening and 25.0 lbs. +/- 5.0 lbs. for closing. The amount of travel for handle movement shall be 100.0 degrees +/- 15.0

(2) Ramp control handle shall be a two position lever assembly that when operated simulates raising and lowering the ramp. The force required for handle movement shall be 1.0 pound +/- 0.5 pounds breakaway and 6.0 pounds +/- 1.0 pound ending. The amount of travel for handle movement shall be 45.0 degrees +/- 7.0 degrees in either direction.

(3) Ramp lock release button shall be a mechanical release button and when depressed shall release the ramp locking handle for movement. The force required for button movement shall be 6.0 pounds +/- 2.0 pounds.

l. Night vision goggles shall be functionally replicated as follows:

(1) A trainer unique momentary pushbutton switch shall be provided to the driver which will enable and disable the night vision capability for both the driver and the commander. The commander will not have independent control of his night vision capability.

(2) Not used.

(3) Not used.

m.Drivers seat shall be fully simulated in the functionality of the operational M113A3.

(1) Driver's seat assembly shall be a seat assembly to provide all adjustments and range of motion required for closed hatch driving as on the M113A3 driver's seat assembly. The back rest shall provide back support as on the M113A3 driver's seat back rest.

(2) Horizontal control handle shall be a two position lever assembly mechanically connected to lock and release the driver's seat. The horizontal control handle shall mechanically allow the seat to be moved to the front or the rear. The handle shall be pulled up while the correct position is being selected. When positioned correctly, the handle shall be released to lock the seat in place.

(3) Vertical control handle shall be a two position lever assembly mechanically connected to lock and release the driver's seat. The vertical control handle shall mechanically allow the seat to be raised or lowered. The handle shall be pulled up while the correct position is being selected. When positioned correctly, the handle shall be released to lock the seat in place.

(4) The drivers seat assembly shall be provided with a mechanically operable seat belt.

n. Brake pedals upper and lower shall be simulated as follows:

(1) Upper brake pedal shall be operational and functional. The travel distance for pedal movement shall be 4.0 inches +/- 2.0 inches.

(2) Lower brake pedal shall be a functional assembly that when operated shall slow and stop the carrier. The force required for pedal movement shall be 4.0 pounds +/- 1.0 pounds breakaway and 45.0 pounds +/- 10.0 pounds ending. The travel distance for pedal movement shall be 4.0 inches +/- 2.0 inches.

o. Beam selector switch shall be a pushbutton switch that when operated shall select high or low headlight beams.

p. Parking brake handle shall be a two position handle assembly that when operated shall engage and disengage the parking brake. The force required for handle movement shall be 2.0 pounds +/- 1.0 pounds breakaway and 12.0 pounds +/- 3.0 pounds ending. The travel distance for handle movement shall be 90 degrees +/- 5 degrees.

q. Tow start handle shall be a two position handle assembly that is operational but nonfunctional.

r. Air cleaner indicator shall be simulated using a functional gauge which shall show the status of the air cleaner element with green to red indications.

s. Hand throttle control shall be a push-pull assembly that when operated shall allow engine speed to be controlled by hand. The force required for handle movement shall be 2.5 pounds +/- 1 pound. The travel distance for handle movement shall be 1.5 inches +/- 0.5 inches.

t. Driver's condition indicator - shall be a trainer unique 2 lamp assembly. An amber lamp shall be illuminated when the driver is considered to be wounded; a red lamp shall be illuminated when the driver is considered dead.

u. Driver's Head Tracker - is a trainer unique item which shall provide feedback indicating where driver's head is located and shall be used for vision block control in the driver's periscopes.

30.1.2.2 Commanders station.

The following buttons, controls, gauges, lights, and switches shall be provided at the commander's station in the locations and panels as found in the actual M113A3.

a. Commander's Periscopes - Five vision blocks (periscopes) shall be provided to the commander which shall display scenes generated by the visual system as specified in Appendix A.

b. Intercom switch box shall be capable of selecting both intercom and radio channels, through the use of the MONITOR switch, a 5 position rotary switch. The intercom volume shall be controlled through the VOLUME knob which shall be simulated by a potentiometer. The intercom panel shall contain two jacks to allow connection of a real CVC helmet to the intercom system.

c. SMOKE grenade ARM-OFF switch shall be a two position lever locked toggle switch (locked in the OFF position) used to arm and disarm the smoke grenade FIRE switch.

d. SMOKE grenade ARM-OFF indicator light shall be a red colored indicator which shall illuminate when the smoke grenade FIRE switch is armed (Arm-Off switch is in Arm position).

e. SMOKE grenade FIRE switch shall be a pushbutton switch with a protective skirt. The switch when pressed, shall Fire smoke grenades from the discharger tubes on the exterior of carrier.

f. Commander's seat assembly shall be a seat assembly to provide all adjustments and range of motion required for closed hatch operation as on the M113A3 commander's seat assembly. The back rest shall provide back support as on the M113A3 commander's seat back rest.

   (1) Vertical control handle shall be a two position lever assembly mechanically connected to allow the commander's seat to be raised or lowered. The handle shall be pushed in while the correct position is being selected. When positioned correctly, the handle shall be released to lock the seat in place.

   (2) Seat lock handle shall be a handle assembly mechanically connected to release the seat from the stowed position. The handle shall be pulled forward to release the commander's seat from the stowed position. The seat shall be lowered until it locks in the down position.

   (3) The commanders seat assembly shall be provided with a mechanically operable seat belt.

g. Cupola controls shall allow for the simulated movement of the commanders cupola gun ring and control of the M2 .50 caliber machine gun.

(1) A two-axis joystick shall be provided which allows for the movement of a simulated .50 caliber machine gun sight horizontally and vertically within the commander vision blocks.

(2) A fire button shall be provided that allows for the simulated firing of the .50 caliber machine gun.

h. Dome light shall be simulated and fully functional. The panel shall have a three position rotary switch which selects blackout or white light. The switch shall have a spring loaded, mechanical only, release button which shall prevent motion from blackout to white, by using a physical block, until button is pressed allowing traversal. The panel shall contain a blackout light and a white light. The dome light shall be located on the right side of the carrier near the commander.

i. Deleted.

j. Precision Lightweight GPS Receiver (PLGR+96 SPS) shall be physically installed as in the operational unit, except where simulated vehicle space constraints apply and functionally replicated as described in paragraph 3.7.6.4.

k. SINCGARS Radio - The SINCGARS (RT-1523A) shall be compatible with organizational requirements except as indicated in 3.7.6 for vehicle and headquarters radio configurations and shall allow for communication with the Operations Center (OC) and other desired units. It shall simulate the following controls:

(1) ANT connector shall be a dummy 3-D connector which shall have a dummy cable. The dummy cable shall connect to the RF power amplifier, for long range capabilities.

(2) CHAN (channel) switch shall select manual, preset and cue frequencies. This switch shall be an 8 - position rotary switch with pointer knob which utilizes the following positions:

(a) CUE - This position shall allow the operator to preset SC frequency for the CUE channel or select the preset CUE frequency.

(b) MAN - This position shall allow the operator to preset SC frequency for the MAN channel or select the preset MAN frequency.

(c) 1 - This position shall allow the operator to preset a SC frequency for channel 1. This position shall also select the preset SC frequency when in SC mode and the FH hopset when in FH mode for channel 1. The loading of preset FH channels or COMSEC keys shall be simulated using the external interface unit.

(d) 2 - This position shall allow the operator to preset a SC frequency for channel 2. This position shall also select the preset SC frequency when in SC mode and the FH hopset when in FH mode for channel 2. The loading of preset FH channels or COMSEC keys shall be simulated using the external interface unit.

(e) 3 - This position shall allow the operator to preset a SC frequency for channel 3. This position shall also select the preset SC frequency when in SC mode and the FH hopset when in FH mode for channel 3. The loading of preset FH channels or COMSEC keys shall be simulated using the external interface unit.

(f) 4 - This position shall allow the operator to preset a SC frequency for channel 4. This position shall also select the preset SC frequency when in SC mode and the FH hopset when in FH mode for channel 4. The loading of preset FH channels or COMSEC keys shall be simulated using the external interface unit.

(g) 5 - This position shall allow the operator to preset a SC frequency for channel 5. This position shall also select the preset SC frequency when in SC mode and the FH hopset when in FH mode for channel 5. The loading of preset FH channels or COMSEC keys shall be simulated using the external interface unit.

(h) 6 - This position shall allow the operator to preset a SC frequency for channel 6. This position shall also select the preset SC frequency when in SC mode and the FH hopset when in FH mode for channel 6. The loading of preset FH channels or COMSEC keys shall be simulated using the external interface unit.

(3) RF PWR switch shall be a 4 position rotary switch with pointer knob, with the following positions:

(a) LO - This position shall set the operation of transmission power to low.

(b) M - This position shall set the operation of transmission power to medium.

(c) HI - This position shall set the operation of transmission power to high.

(d) PA - This position shall set the operation of transmissions for use with the power amplifier, or high power if power amplifier is not connected to the RT.

(4) MODE Switch - This switch shall be a 3 - position rotary switch with pointer knob, with the following positions:

(a) SC - This position shall set the Receiver/Transmitter to SC (single channel) mode.

(b) FH- This position shall set the Receiver/Transmitter to FH (frequency hopping) mode.

(c) FH-M - This position shall set the Receiver/Transmitter to FH-M (frequency hopping master) mode. The operator shall be required to pull the switch to go into the FH-M position.

(5) RXMT connector shall be a dummy 3-D connector.

(6) FCTN(function) Switch - This switch shall be a 9 - position rotary switch with pointer knob, with the following positions:

(a) STBY - This position shall turn off receiver/transmitter (RT) while maintaining memory. The operator shall be required to pull the switch knob in order to go to the STBY position.

(b) TST - This position shall cause the normal self test indicators to be displayed on the keyboard display.

(c) LD - This position shall load SC frequencies, and shall also allow the operator to receive ERF data from a RT operating in FH-M mode.

(d) SQ ON - This position shall turn on the RT and activate the squelch.

(e) SQ OFF - This position shall turn on the RT and deactivate the squelch.

(f) RXMT - This position shall be nonfunctional. The retransmit mode of the RT shall not be simulated.

(g) REM - This position shall disable the RT’s front panel controls.

(h) Z-FH - This position shall clear the RT of all FH data. The operator shall be required to pull the switch knob in order to go to the Z-FH position.

(i) OFF - This position shall turn off all power to the RT. This function shall also erase the RT’s memory. The operator shall be required to pull the switch knob in order to go to the OFF position.

(7) DIM Control - This shall be a active control which replicates the appearance and function of the corresponding actual knob.

(8) Keyboard Display shall display all information concerning the operation of the RT including SC frequencies, FH data, error messages, data rates as well as keyboard entries. The display shall consist of 8 full 5 X 7 dot matrix characters that are alphanumeric with the capability to display special characters. The seventh 5 X 7 dot matrix character shall be capable of displaying no dots on column number one, on column number two only displaying dots on rows one, three, five, and seven that have the capablility to be lighted individually, no dots on column number three, and capable of lighting all the dots on columns four and five at the same time. The

eighth dot matrix character shall also be capable of displaying dots arranged in the form of a diamond. All displays shall be dimmable. Color of display shall be green.

(9) Keypad shall be responsible for the entering data into the RT. The keypad shall consist of the following 16 pushbutton keys:

(a) CMSC 1 - Shall display the COMSEC key identifier number on the display and enter the number ’1’ into the system.

(b) * 2 - Shall enter the number ’2’ into the system. The special feature activated by this key on the actual RT shall not be selectable or simulated.

(c) SYNC 3 - Shall place the RT into ’late entry’ status allowing the RT to re-enter the network. Also shall enter the number ’3’ into the system.

(d) FREQ - Shall allow the operator to load and clear SC frequencies in the RT.

(e) DATA 4 - Shall display the RT’s operational data rate and enter the number ’4’ into the system.

(f) 5 - Shall enter the number ’5’ into the system.

(g) 6 - Shall enter the number ’6’ into the system.

(h) ERF OFST - Shall transmit ERF data to net members when RT is operating in FH-M mode. Also shall load/check SC offset frequencies.

(i) CHG 7 - Shall change current information on display to another available selection. Shall also enter the number ’7’ into the system.

(j) 8 - Shall enter the number ’8’ into the system.

(k) LOUT 9 - Shall enter the number ’9’ into the system. Shall also retrieve the frequency lockout sets from permanent memory if the RT is operating as Frequency Hop Master.

(l) TIME - Shall be used to check RT FH sync time clock.

(m) CLR - Shall clear data from display if error was made during entry. Shall also be used to clear data from RT memory.

(n) LOAD 0 - Shall load data into holding memory in RT and to retrieve data from permanent memory into holding memory. Shall also be used to enter the number ’0’ into the system.

(o) STO- Shall transfer data from RT holding memory onto permanent memory.

(p) BATT CALL - Shall be non-functional.

(10) COMSEC switch shall be responsible for controlling the communication security modes of the RT. It shall be a 5 - position rotary switch with pointer knob, with the following positions:

(a) PT - This position shall place the RT into plain text mode. The operator shall be required to pull the knob in order to place the knob into this position.

(b) CT - This position shall place the RT into cipher text mode.

(c) TD - This position shall be non-functional.

(d) RV - This position shall prepare the RT to receive a remote fill of COMSEC variables from the NCS.

(e) Z - This position shall clear COMSEC keys. The operator shall be required to pull the knob in order to place the knob into this position.

(f) deleted

(11) VOL WHSP control shall be a rotational knob used for audio volume control. The knob shall also provide a pullout position which shall be non-functional.

(12) HUB Connector - Dummy cover that shall not be removable.

(13) AUD/FILL connector shall be a dummy 3-D connector.

(14) AUD/DATA connector shall be a dummy 3-D connector connected to the mounting adapter by a dummy cable.

l. Radio Mounting - the SINCGARS shall be mounted in a long range radio configuration. This mounting shall replicate the AN/VRC-90A configuration which contains the following components:

(1) Amplifier-Adapter, Vehicular (mounting adapter) AM-7239B/VRC.

(2) Amplifier, Radio Frequency AM-7238A/VRC.

(3) Receiver-Transmitter, Radio RT-1523 A.

(4) Loudspeaker Control Unit, LS-671/U.

The Configuration shall be replicated as follows:

(1) Mounting adapter shall have one SINCGARS receiver-transmitters as described in 30.1.2.2.k. The mounting adapter shall have a simulated Radio Frequency Amplifier connected, and shall also have the following components:

(a) CB1 (power) switch shall be a two position tripable toggle switch with an ON and OFF position.

(b) Indicator lamp and lens shall be a green dimmable indicator. The indicator shall flash for 3 +/- 1 seconds after the CB1 switch is moved to the ON position, then stays lit. The lens shall allow the indicator to be dimmed by turning clockwise.

(c) The (AUD/DATA B J2) connector shall be a 3-D dummy connector.

(d) The (AUD/DATA A J3) connector shall be a 3-D dummy connector.

(e) The (DATA B J4) connector shall be a 3-D dummy connector.

(f) The (DATA A J5) connector shall be a 3-D dummy connector with a dummy cable connected to the AUD/DATA connector on the bottom radio.

(g) The (SPKR J6) connector shall be a 3-D dummy connector.

(2) The Radio Frequency Amplifier shall be connected to the mounting adapter. The Radio Frequency Amplifier shall have the following components:

(a) The (J1) connector shall be a dummy connector. A dummy cable which represents the connection to a vehicle antenna shall be connected to the J1 connector.

(b) The (J2) connector shall be a dummy connector. A dummy cable which also connects to the ANT connector of the RT mounted in the mounting adapter shall be connected to the J2 connector.

m. Commander’s Condition Indicator - shall be a trainer unique 2 lamp assembly. An amber lamp shall be illuminated when the commander is considered to be wounded; a red lamp shall be illuminated when the commander is considered dead.

n. Commander’s Head Tracker - is a trainer unique item which shall provide feedback indicating where commander’s head is located and shall be used for vision block control in the commander’s periscopes.

o. ROUNDS IN STORAGE - shall be a trainer unique panel used to monitor the storage and control the removal of ammo from the 0.50 caliber ammo storage area. The following components shall be provided:

(1) ROUNDS IN STORAGE shall be a 4 digit display that indicates the simulated number of ammo rounds in the ammo storage area.

(2) FILL WEAPON AMMUNITION BOX shall be a pushbutton switch that initiates the simulated transfer of an ammo can from the storage area to the 0.50 caliber machine gun ammunition box.

p. ROUNDS IN AMMUNITION BOX - shall be a trainer unique panel indicating the number of rounds in the ammunition box.

q. MACHINE GUN - shall be a trainer unique panel used to control and monitor the loading and unloading of the 0.50 caliber machine gun. The following components shall be provided:

(1) LOAD/UNLOAD shall be a pushbutton switch that when depressed will initiate the loading of the 0.50 caliber machine gun if unloaded or unload the 0.50 caliber machine gun if loaded.

(2) LOADED indicator shall be a red indicator that illuminates when the 0.50 caliber machine gun is loaded. The indicator shall flash during the simulated load time.

(3) UNLOADED indicator shall be a green indicator that illuminates when the 0.50 caliber machine gun is unloaded. The indicator shall flash during the simulated unload time.

r. Audio Frequency Amplifier (AM 1780/VRC) shall be functionally replicated as follows:

(1) MAIN PWR switch shall be a three position rotary switch with pointer knob and shall have active positions labeled “NORM”, “INT ONLY”, and “OFF”. No radio transmission shall be possible when MAIN PWR is in INT ONLY position. The entire communications system shall be turned off when MAIN PWR switch is in OFF position.

(2) INT ACCENT switch shall be a two position rotary switch with pointer knob and active positions labeled “ON” and “OFF”.Intercom and radio sound levels shall be equal when INT ACCENT switch is set to OFF. Radio sound levels shall be lower than intercom when INT ACCENT switch is set to ON.

(3) RADIO TRANS switch shall be a three position rotary switch with pointer knob and shall have active positions labeled “CDR + CREW”, “CDR ONLY”, and “LISTENING SILENCE”. Entire crew shall be able to transmit on radio with RADIO TRANS switch in CDR + CREW position. Only tank commander shall be able to transmit on radio when RADIO TRANS switch is in CDR ONLY position. No radio transmission shall be possible with RADIO TRANS switch in LISTENING SILENCE position.

(4) POWER CKT BKR switch shall be a two position trippable toggle type circuit breaker.

(5) POWER light shall be a green lamp and shall indicate when power is applied to the communication system.

(6) INSTALLATION switch shall be a three position rotary switch requiring a flat blade screwdriver to change switch setting and shall have active positions labeled “INT ONLY”, “OTHER”, and “RETRANS”.

(7) AUDIO INPUT jacks shall be non-operational and non-functional.

(8) LINE jacks shall be non-operational and non-functional.

s. Simulated compass (grid azimuth indicator) shall be a three digit display depicting the orientation of the long axis of the vehicle on the simulated terrain referenced to grid north. The simulated compass shall be available inside the compartment only after the vehicle has been stationary for 15 seconds.

30.1.2.3 External interface unit.

The M113A3 manned module shall be provided with an External Interface Unit (EIU) that consists of an entry device and display device. The EIU shall be used to control and monitor the following functions:

a. Exercise number.

b. Vehicle identification number.

c. Notification of a self-repair being completed.

d. Initiation and termination of fuel transfers.

e. Initiation and termination of ammo transfers.

f. Connection and disconnection of a tow kit to another vehicle.

g. External munitions loading.

h. Damage assessment.

i. Load SINCGARS hopset and COMSEC data.

APPENDIX H
M1A1 MANNED MODULE

10. Scope.

This appendix establishes requirements for the M1A1 manned module.

20. Applicable Documents.

(This section is not applicable to this appendix.)

30. Requirements.

30.1 M1A1 Simulator Module.

The M1A1 simulator shall be designed to replicate the performance characteristics of the M1A1 vehicle and associated systems as described in H.30.1.1 through H.30.1.2.3. These characteristics shall enable the M1A1 simulators to operate in the CCTT environment and shall provide the manned crew the system performance specified herein.

30.1.1 Performance Characteristics.

The following paragraphs contain the minimum detailed performance requirements that shall be provided with the M1A1 simulator system. The M1A1 manned module shall also meet the generic design requirements of section 3.6.

30.1.1.1 Deleted.

30.1.1.2 Fire Control System.

The fire control system for the M1A1 simulation system shall replicate the capability for target acquisition, aiming and firing of the 120 mm main gun, 0.50 caliber machine gun, M240 7.62 mm coaxial machine gun and M250 smoke grenade launcher. The simulated fire control system components shall replicate the operational equipment in both design and performance. The fire control system shall consist of:

a. Gunner’s Primary Sight (GPS)

b. Gunner’s Auxiliary Sight (GAS) with browpad

c. Gunner’s Control Panel

d. Gunner’s control handles

e. Laser Range Finder (LRF)

f. Commander’s GPS Extension

g. Commander’s control handles

h. Commander’s Weapon Station (CWS)

These components in combination with the other simulated systems in the M1A1 simulation system shall provide the tank crew the capability to engage targets from both stationary and on the move positions with a precision that matches real world results. The simulated fire control system shall accurately incorporate sighting reticles and fire control models and shall enable precision gunnery techniques in simulated battle field environments.

30.1.1.3 M1A1 Weapons and Ammunition.

The M1A1 simulation system shall simulate the following weapons and ammunitions:

a. 120 mm main gun,
   (1) M829 APFSDS -T Cartridge,
   (2) M830 HEAT-MP -T Cartridge,

b. M2 0.50 Cal. Machine Gun, (A534 API-T),

c. M240 7.62 mm coaxial machine gun, A141, Ball, Tracer,

d. M250 smoke grenade launcher system using the L8A3 RP smoke grenades.

30.1.1.4 Support Systems.

30.1.1.4.1 Electrical System.

The electrical system shall be capable of the following operating states:

a. Engine off, master power off.

b. Engine off, master power on, turret power on.

c. Engine running, alternator working, turret power on.

d. Engine running, alternator broken, turret power on.

e. Engine off, master power on, turret power off.

f. Engine running, alternator working, turret power off.

g. Engine running, alternator broken, turret power off.

Based on which operating state the electrical system is in, the associated problems and abilities shall be reflected in the M1A1 simulation system. These problems and abilities shall be replicated in the M1A1 simulation systems just as they would occur in the operational equipment.

30.1.1.4.2 Hydraulic System.

The hydraulic system shall cover the use of both the main and auxiliary hydraulic pumps. The operation of the slewing of the turret, elevation of the gun, the opening and closing of the ammunition door, and the setting of the parking brake shall take into account the status of the hydraulic system. The operation of the two hydraulic pumps and the associated systems shall be reflected in the M1A1 simulation system replications of the operational equipment.

30.1.1.5 Depletable Resource Management.

Depletable resources management shall cover the management, consumption, and resupply of both fuel and ammunition. The fuel for the M1A1 simulation system shall be based on the use of three fuel tanks as found in the actual M1A1 tank. The management of maintaining fuel in the rear tank and the associated transfer of fuel from the own fuel tanks shall be the responsibility of the tank crew through normal operations at their respective stations. The resupply of fuel shall be accomplished through coordination with the ALOC and shall occur with the use of a fuel carrier. The ammunition for the M1A1 simulation system shall be based on the storage capabilities of the actual M1A1 tank for weapons and ammunition identified in H.30.1.1.3. The identification, transfer and resupply of ammunition shall be the responsibility of the Loader. In all cases, the monitoring of, use of and resupplying of the M1A1 tank's fuel and ammunition shall be based on the implementation of representative time and depletion parameters. The Resupply Operations shall include:

a. Simulated Transfer of:

(1) Fuel from one internal tank to another within a module

(2) Fuel from a fuel carrier and fuel pre-stock to the M1A1 tank

(3) Ammunition from the ready rack to the breach

(4) Ammunition from the hull storage rack to the ready rack.

(5) Ammunition from the semi-ready rack to the ready rack

(6) Ammunition from an ammunition truck or another M1A1, M1A2, and Manned Module with comparable ammunition

(7) Ammunition from prepositioned ammunition stocks

(8) Reload times for the weapons listed in paragraph H.30.1.1.3

30.1.1.6 Damage and Failure.

The list of components that are modeled for combat damage, stochastic failure, and deterministic failure shall be as defined in Table H-I.

Table H-I. M1A1 Failures and Damage

Component/System	Deterministic	Stochastic	Combat Damage
Air Filter		X	
Antenna A and B			X
Ballistic Computer		X	
Cmdr's GPS Extension Optics		X	
Cmdr's Power Control Handle		X	
Coax Gun Inoperative		X	X
Commander			X
Driver			X
Drown	X		
Electronics			X

Table H-I. M1A1 Failures and Damage

Component/System	Deterministic	Stochastic	Combat Damage
Engine Assembly			X
Engine Loss of Power		X	
Engine Oil Filter		X	
Engine Oil Pump		X	
Engine Oil System			X
Engine Pilot Relay		X	
Engine Shutdown		X	
Engine Starter	X	X	X
Fuel Filter		X	
Fuel Transfer Motor		X	
GPS Both		X	X
GPS Day		X	X
GPS Reticle		X	
GPS Reticle Adjust		X	
GPS Thermal		X	X
Gun Elevation Drive Filter	X	X	
Gun Elevation Drive Servo	X	X	
Gun Elevation Drive Valve	X	X	
Gunner			X
Gunner’s Auxiliary Sight		X	
Gunner’s Power Control Handles		X	
Hull Ammunition			X
Ignitor		X	
Intercom			X
Laser Range Finder	X	X	
Left Idler Wheel			X
Left Roadwheel 1			X
Left Roadwheel 2			X

Table H-I. M1A1 Failures and Damage

Component/System	Deterministic	Stochastic	Combat Damage
Left Roadwheel 3			X
Left Roadwheel 4			X
Left Roadwheel 5			X
Left Roadwheel 6			X
Left Roadwheel 7			X
Left Sprocket			X
Left Track	X		X
Loader			X
Mirror Elevation Drive		X	
MRS Optics		X	
Oil Cooler		X	
Oil Cooler Fan		X	
Parking Brake		X	
PLGR	X		
Radio A			X
Radio B			X
Right Idler Wheel			X
Right Roadwheel 1			X
Right Roadwheel 2			X
Right Roadwheel 3			X
Right Roadwheel 4			X
Right Roadwheel 5			X
Right Roadwheel 6			X
Right Roadwheel 7			X
Right Sprocket			X
Right Track	X		X
Rollover	X		
Transmission Assembly		X	X
Transmission Oil Filter		X	

Table H-I. M1A1 Failures and Damage			
Component/System	**Deterministic**	**Stochastic**	**Combat Damage**
Transmission Oil System			X
Turret Ammo Ready			X
Turret Ammo Semi			X
Turret Ammunition			X
Turret Azimuth Drive Filter	X	X	
Turret Azimuth Drive Servo	X	X	
Turret Azimuth Drive Valve	X	X	
Turret Stabilization		X	

30.1.1.7 Sound Generation System.

A sound and acoustic vibration generation system shall be provided. The sound system shall be completely separate from the communication system, and the sounds and vibrations shall be presented independently from any headphone system (i.e. multiple loudspeakers). The sounds and vibrations shall be of such fidelity, quality, realism, and volume that crew members shall experience the cues, stresses, and distractions of a "real life" combat situation. The sounds shall be of sufficient volume so that the distractions provided to the crew members shall equal that found in an actual situation, but in no case shall 95 dB be exceeded for steady state noise (measured external to the CVC helmet). Table G-II lists the sound cues that shall be provided in the M1A1 simulation system.

Table H-II. M1A1 Sound Cues
SOUND CUE
Engine start to idle
Engine stop
Engine noise related to Revolutions Per Minute (RPM)
Transmission noise related to RPM
Parking brake set
Parking brake release
Track noise related to speed for terrain types simulated in CCTT
Track popping (about to be thrown)
Turret traverse noise related to turret RPM
Main gun couple
Main gun uncouple
Gun elevate

Table H-II. M1A1 Sound Cues
SOUND CUE
Gun hitting upper or lower limits
Open Breech/ load round/ close breech
Close Breech/ unload round/ close breech
Fuel transfer pump
Bilge Pump
Auxiliary hydraulic pump
Cupola Rotation
NBC system main and coax blower
Collisions with objects (scraping and hard collisions)
Fire main gun / discharge casing
Fire .50 caliber machine gun
Fire 7.62 mm machine gun
Fire smoke grenade launcher
Friendly and hostile main gun fire
Friendly and hostile missile launch
Friendly and hostile rocket launch
Generic explosive round (main gun, missile, rocket) hit
Generic explosive round (main gun, missile, rocket) miss
Generic kinetic round kit
Friendly and hostile machine gun fire - large caliber
Friendly and hostile machine gun fire - small caliber
Friendly and hostile mine hit
Friendly and hostile bomb hit
Friendly and hostile bomb miss
Friendly and hostile artillery hit
Friendly and hostile artillery miss
Wheeled vehicle - large class
Wheeled vehicle - small class
Tracked vehicle
Aircraft - rotary wing class
Aircraft - fixed wing class

30.1.1.7.1 Sound Synchronization.

The sound system shall be synchronized with the visual displays and the M1A1 controls within the system latency requirements, as defined in paragraph 3.2.2.1, and within the module latency requirements, as defined in paragraph 3.2.2.2.

30.1.1.7.2 Sound Generator.

During real-time operation, the desired sounds shall be stored in the sound system and shall be available in real-time to the vehicle simulator. The system shall provide outputs for driving speakers and sub-woofers. The sound generation system shall have the ability of generating a minimum of eight sounds simultaneously with full parametric control of frequency and volume. Where appropriate, sound generation channels shall be "shared" by several different sounds on a priority basis. The number of sound generation channels shall be expandable to allow for future needs that may require the capability to generate a larger number of sounds simultaneously.

30.1.1.7.3 Sound Storage.

The M1A1 simulation system shall have the capacity to store all sound data and shall be expandable to allow for future increases in storage that would be necessary to generate a larger base of sound data.

30.1.1.7.4 Spatial Positioning.

The sound system shall provide for spatial positioning of the sound cues. The sounds shall be synchronized with the actions causing the sounds and shall be presented to allow personnel the ability to identify the distance (amplitude and time delay) of the events causing the sounds. For the Popped Hatch speakers, the sounds shall be synchronized with the actions causing the sounds and shall be presented to allow personnel the ability to identify the direction of the events causing the sounds.

30.1.1.7.5 Audio Amplifiers.

The audio amplifiers shall be of sufficient quality and power-handling ability to recreate the required volume levels without distortion greater than 0.05 percent Total Harmonic Distortion (THD) over the dynamic range.

30.1.1.7.6 Speakers.

Audio cues shall be presented via speakers contained in each of the manned module crew compartments. The speaker configuration for the M1A1 manned modules shall be as defined in Table H-III. Headphones shall not be required to present the ambient "sounds of battle." Vibration cues (e.g. vehicle vibrations, weapons fire, and vibrations from explosions) shall be presented to the crew members through the use of subwoofers. Popped hatch speaker placement within the modules shall support spatial positioning.

Table H-III. M1A1 Module Speaker Arrangement

MODULE TYPE		SPEAKER	SEAT SPEAKER	SUBWOOFER
M1A1	Driver compartment	4	1	1
	Crew compartment	4	3	1

M1A1 CPH	Driver compartment	4	1	1
	Crew compartment	4	3	1
	Popped hatch	4	0	0

30.1.1.7.7 Sound Quality.

The sound generator shall provide a frequency range of 25 Hertz (Hz) +/- 5 Hz to a minimum of 12,000 Hz. The audio amplifiers shall provide a frequency range of 25 Hz +/- 5 Hz to a minimum of 20,000 Hz. The combined signal to noise ratio of the sound generator and audio amplifiers shall be a minimum of 70 dB. The combination of speaker types shall provide a composite frequency response of 25 Hz to 20,000 Hz +/- 10 dB (after each speaker has been independently referenced to 0 dB).

30.1.1.8 Communication System.

A communication system shall be provided to the M1A1 simulation system as described in section 3.7.6 of this specification.

30.1.1.9 Visual Display System.

The visual display system shall meet the requirements stated in Appendix A, Visual System For The Close Combat Tactical Trainer.

30.1.2 Physical Characteristics.

The following paragraphs contain the detailed physical requirements that shall be provided for the individual crew stations within each M1A1 simulator system. The M1A1 crew compartment shall exist as two separate enclosures: an enclosure for the driver's station, and an enclosure for the tank commander, the gunner, and the loader stations. Each of these stations shall include seats replicating those respective seats (including full range of motion and adjustments) found in the operational M1A1 tanks as well as the controls, indicators and other pieces of equipment. The module enclosure base shall provide support for all module components and shall incorporate forklift provisions to facilitate handling and transportation. Functional controls, indicators, and other pieces of equipment shall have proper coloring and labels. All items must be located in the same position as the actual vehicle within the tolerance of this specification. The modules shall provide the controls, switches, indicators and space constraints required to meet the training tasks while avoiding negative training. Some of these items shall be fully replicated while others shall be mock-ups to provide the tactile sensations and space constraints of the actual vehicle. The controls and indicators shall replicate in design, performance, and function their real world couter-parts that are found in the operational M1A1. Realistic control loading and physical limits of travel shall be provided for simulated crew member controls, such as pedals, handles and steering controls.

30.1.2.1 Driver's Station.

The following controls, switches, gauges, and lights shall be provided at the Driver's station in the locations and panels as found in the actual M1A1.

a. The following controls, indicators, and other pieces of equipment shall be simulated (functional):

(1) Service brake shall control simulated hydraulic operation of brakes in the transmission. The service brake pedal assembly shall simulate the M1A1 tank service brake pedal assembly. Deflecting the brake pedal shall result in additional resistance to the rotation of the vehicle tracks. The service brake shall only be functional when the engine is running. In the event of an engine shutdown, the service brake shall be non-functional when vehicle speed is below 3 MPH. Maximum deflection of the service brake pedal shall be 15 degrees (+/- 2.25 degrees). Breakaway force shall be 12.5 lbs (+/- 4.0 lbs) and ending force shall be 54 lbs (+/-8lbs), both measured 10 inches from the pivot point.

(2) Parking brake assembly shall consist of the Parking brake pedal and the Parking brake release handle.

(a) The Parking brake pedal shall operate the brakes in the transmission. The parking brake pedal shall simulate the M1A1 tank parking brake pedal. Pressing the parking brake when it is not already engaged and the parking brake release handle is not pulled shall activate the parking brake inhibiting movement of the tracks. The parking brake shall take into account the current state of the hydraulic system. Maximum deflection of the parking brake pedal shall be 13 degrees (+/-5 degrees). Ending force shall be 51 lbs (+/-8.0 lbs) measured on the pedal 7.25 inches from the parking brake pivot axis.

(b) The parking brake release handle shall be an assembly which shall release the parking brake. The parking brake release handle shall simulate the M1A1 tank parking brake release handle. Pulling the release handle shall disengage the parking brake, allowing the tracks to rotate. The parking brake release shall be functional at all times. The force required to disengage the parking brake shall be 53 lbs (+/-8 lbs). Total travel of the parking brake release shall be 5.75 in (+/-0.9 in). The parking brake shall disengage at 5.5 in (+/-0.8 inch).

(3) Steering/Throttle control assembly shall consist of the steering control, the throttle control, the transmission control, intercom buttons and adjustment knob.

(a) The Steering control shall be a potentiometer assembly. Deflection of the steering control from center position shall command the vehicle to turn. The steering control shall only be functional when the engine is running and the loss of steering malfunction is not active. In the event of an engine shutdown or activation of the loss of engine power malfunction while the vehicle is moving, the steering control shall be non-functional when vehicle speed is below 3 MPH. Steering control deadband shall be 14 degrees +/-3 degrees. Breakaway force of the steering mechanism shall be 17 lbs (+/- 3 lbs) applied 7.5 inches from the centerline of the steering assembly. Ending force shall be 35 lbs (+/- 7 lbs) applied 7.5 inches from the steering assembly pivot axis. Specified breakaway and ending forces shall apply to deflection in either direction.

(b) The throttle control shall be physically and functionally replicated. The throttle control shall have a deadband of 2.5 degrees +/- 1.5 degrees. Maximum deflection shall be 62 degrees (+/- 9.3 degrees). Breakaway torque of the throttle control shall be 4 in-lbs (+/- 2 in-lbs). Ending torque shall be 10 in-lbs (+/- 5 in-lbs). Deflection of the throttle control from the full forward position shall cause additional fuel flow in the engine dynamics model. The throttle control shall only be functional when the engine is running and the loss of engine power malfunction is not active.

(c) The transmission shift control shall provide 5 gear selections: neutral (N), pivot (PVT), reverse ®, drive (D) and low (L). Transmission selections shall modify the action of the engine output. The transmission control shall only be functional when the engine is running.

(d) The Left and Right intercom press to talk buttons shall enable the driver to talk over the communications subsystem without removing his hands from the steering/throttle control.

(e) The steering/throttle control adjustment knob shall be functional and shall provide the capability to adjust steering/throttle assemblies position.

(4) Driver's Instrument panel shall be functionally replicated. The following switches and indicators on the Driver's Instrument panel shall be replicated and function as described:

(a) MAINTENANCE MONITOR indicators shall function as described with one discrete output respectfully:

i. ENGINE OIL LOW indicator - This amber indicator shall be illuminated while the engine is running and the engine oil level is low or when a lamp test is performed.

ii. CABLE DISCONNECTED indicator - This amber indicator shall be illuminated when a lamp test is performed or under independent software control.

iii. CIRCUIT BREAKER OPEN indicator - This amber indicator shall be illuminated when a virtual/active circuit breaker in the hull of the vehicle has been opened or when a lamp test is performed.

iv. HYDRAULIC SYSTEM malfunction indicator - This amber indicator shall be illuminated to indicate a hydraulic system malfunction exists while the engine is running or when a lamp test is performed.

v. NOT IN OPERATION indicator - This amber indicator shall be illuminated only when a lamp test is performed.

vi. ENGINE OIL CLOGGED FILTER indicator - This amber indicator shall be illuminated while the engine is running and a engine oil filter clogged condition exists or when a lamp test is performed.

vii. TRANSMISSION OIL CLOGGED FILTER indicator - This amber indicator shall be illuminated when a lamp test is performed or under independent software control.

viii. PRIMARY FUEL CLOGGED FILTER indicator - This amber indicator shall be illuminated while the engine is running and a primary fuel filter clogged condition exists or when a lamp test is performed.

ix. AIR CLEANER CLOGGED FILTER indicator - This amber indicator shall be illuminated when a lamp test is performed or under independent software control.

x. REAR FUEL PUMP-R INOPERATIVE indicator - This amber indicator shall be illuminated when a lamp test is performed or under independent software control.

xi. REAR FUEL PUMP-L INOPERATIVE indicator - This amber indicator shall be illuminated when a lamp test is performed or under independent software control.

xii. FUEL CONTROL FAULTY indicator - This amber indicator shall be illuminated when a lamp test is performed or under independent software control.

xiii. SPARE indicator - This amber indicator shall be illuminated only when a lamp test is performed.

(b) ENGINE indicators shall function as described with one discrete output respectfully:

i. OIL TEMP HIGH indicator - This red indicator shall be illuminated when a lamp test is performed or under independent software control.

ii. OIL PRESS LOW indicator - This red indicator shall be illuminated when a lamp test is performed or under independent software control.

iii. OVERSPEED indicator - This red indicator shall be illuminated whenever the engine is running and the engine speed is more than 3100 RPM.

iv. 2ND SHOT switch - This switch shall be a 2-position toggle switch with red guard/cover. Setting this 2-position toggle switch to the ON position shall cause the engine to be shutdown and the engine shutdown sequence aural cue to be activated. Any existing simulated fire shall be extinguished and the engine shutdown.

v. 1ST SHOT DISCHARGED indicator - This amber indicator shall be illuminated when a lamp test is performed or under independent software control.

vi. FIRE indicator - This red indicator shall be illuminated when a lamp test is performed or under independent software control.

vii. Engine RPM gauge indicator - The rotational speed of the engine shall be indicated on this gauge whenever the vehicle master power is on. The RPM gauge shall have a range of 0-3600 with a full scale accuracy of +/- 100 RPM.

viii. Internal Engine RPM gauge light - This red indicator shall be illuminated whenever the vehicle master power is on.

ix. Engine GAS OVERTEMP indicator - This red indicator shall be illuminated when a lamp test is performed or under independent software control.

x. TANK SELECTOR switch - This switch is a 3-position, rotary switch which shall have detents and stops at each end of the switch. Setting this switch to the right or left front tank selection when the rear tank is less than 1/8 full shall cause fuel to be transferred from the selected tank to the rear fuel tank.

xi. Fuel gauge indicator - This indicator shall indicate the amount of fuel remaining in the fuel tank selected by the tank selector switch whenever the vehicle master power is on.

xii. Internal Fuel gauge light - This red indicator shall be illuminated whenever the vehicle master power is on.

xiii. LOW FUEL LEVEL indicator - This amber indicator shall be one discrete output which shall be illuminated whenever the vehicle master power is on and the fuel level in the rear fuel tank is below 1/8 full; light shall go out by the time 3/8-full is indicated.

xiv. Transmission OIL TEMP HIGH indicator - This red indicator shall be illuminated when a lamp test is performed or under independent software control.

xv. Transmission OIL PRESS LOW indicator - This red indicator shall be illuminated when a lamp test is performed or under independent software control.

xvi. Transmission DAMAGED-INSPECT indicator - This red indicator shall be illuminated when a lamp test is performed or under independent software control.

xvii. VEHICLE SPEED gage indicator - Whenever vehicle master power is on this gage shall indicate vehicle speed based upon the rotational speed of the transmission. The gauge shall have a range of 0 to 96 with a full scale accuracy of +/- 2 MPH.

xviii. Internal Vehicle speed gauge light - This red indicator shall be illuminated whenever the vehicle master power is on.

xix. Odometer indicator - This indicator shall be a seven digit numeric indicator which shall simulate the distance the vehicle has traveled in kilometers.

xx. ELECTRICAL SYSTEM gauge indicator - This indicator shall indicate voltage whenever the vehicle master power is on. The indicated voltage shall reflect the current electrical system status.

xxi. Internal Electrical system gauge light - This red indicator shall be illuminated whenever the vehicle master power is on.

xxii. LOW BAT CHARGE indicator - This amber indicator shall be one discrete output and shall be illuminated when electrical system voltage is low or a lamp test is performed.

(5) Driver’s Master panel shall be functionally replicated. The following switches and indicators on the Driver’s Master panel shall be replicated and function as described:

(a) PERSONAL HEATER switches/indicators shall function as described:

i. HIGH/LOW temperature switch - This shall be physically and functionally replicated with the exception that it will not cause air temperature to be modified.

ii. Personnel Heater indicator - This green indicator shall be one discrete output and illuminated when a lamp test is performed or when the personnel heater run/fan switch is in the START or RUN/FAN positions.

iii. RUN/FAN switch - This switch shall be a 3-position toggle switch. This switch shall cause the personnel heater indicator to be activated whenever the switch is in the START or RUN/FAN position.

(b) Night Periscope switches/indicators shall function as described:

i. NIGHT PERISCOPE indicator - This green indicator shall be one discrete output and illuminated when the vehicle master power is on and the Night Periscope switch is in the on position or a lamp test is performed.

ii. Night Periscope ON/OFF switch - This switch shall be a 2-position toggle switch. The switch shall control power to the power cable which supplies the night vision device with simulated power.

(c) Bilge Pump switches/indicators shall function as described:

i. BILGE PUMP indicator - This green indicator shall be one discrete output and shall illuminate when the vehicle master power is on and the Bilge Pump switch is in the on position.

ii. Bilge Pump ON/OFF switch - This switch shall be a 2-position toggle switch. The switch set to the ON position shall cause the aural cue to be activated and the Bilge Pump indicator to be illuminated.

(d) Smoke Generator switches/indicators shall function as described:

i. SMOKE GENERATOR indicator - This green indicator shall be one discrete output and shall illuminate when the engine is running and the Smoke Generator switch is set to the ON position or a lamp test is performed.

ii. Smoke Generator ON/OFF switch - This switch shall be a 2-position toggle switch.

(e) LIGHTS switch - this switch shall be a 4-position rotary switch with push-to-turn between the OFF and STOP LIGHTS ONLY position. The switch shall turn simulated power on/off to outside blackout markers, stop light, and service lights (headlights).

(f) High Beam switches/indicators shall function as described:

i. HIGH BEAM indicator - This green indicator shall be one discrete output and illuminated when the service lights are on and the High Beam switch is in the ON position.

ii. High Beam ON/OFF switch - This switch shall be a 2-position toggle switch. Setting the switch to the ON position shall cause the high beam indicator to be illuminated if the service lights are on.

(g) Vehicle Master Power switches/indicators shall function as described:

i. VEHICLE MASTER POWER indicator - This green indicator shall be one discrete output and illuminated when the Vehicle Master Power switch is in the ON position.

ii. VEHICLE MASTER POWER switch - This switch shall be a 3 position toggle switch momentary to the up (ON) and down (OFF) positions. The switch set to the ON position shall illuminate the vehicle master power green indicator, all gauges lights, and all gauges on the Driver's Instrument Panel begin to function. Setting the Vehicle Master Power switch to the OFF position shall inhibit the functioning of all driver compartment switches and indicators except for the following: Parking Brake, Parking Brake Release, Hydraulic Pressure gauge.

(h) PARKING SERVICE BRAKES ON indicator - This red indicator shall be one discrete output and illuminated when the service brake pedal is depressed for more than 2 minutes (+/- 5 seconds) with engine running and vehicle master power is on or a lamp test is performed or parking brake pedal is depressed.

(i) Engine switches/indicators shall function as described:

i. STARTED indicator - This green indicator shall be one discrete output and shall illuminate for 10 seconds (+/- 1 second) when the engine startup sequence is completed or a lamp test is performed.

ii. PUSH TO START switch - This switch shall be a pushbutton and pressing this pushbutton for approximately one second shall cause the engine startup sequence to begin if vehicle master power is on, there is fuel in the rear fuel tank, the transmission is in neutral, and the engine is not already running.

iii. ABORT indicator - This amber indicator shall be one discrete output and illuminated whenever an engine start sequence has been aborted by a engine failure or when a lamp test is performed.

iv. TACTICAL IDLE switch - This switch shall be a 2-position toggle switch with active positions “ON” and “OFF”. Setting this switch to the ON position when the engine is running shall cause the engine idle speed to be increase from 900 RPM (+/- 30 RPM) to 1300 (+/- 50 RPM).

v. SHUTOFF switch - This switch shall be a 2-position lever lock toggle switch and setting this switch to the SHUTOFF position when engine is running shall shutdown the engine and activate the engine shutdown sequence aural cue. The switch shall return to the center position when released.

vi. STARTER ONLY ENGAGED switch - This switch shall be a 2-position momentary toggle switch. Setting this switch to the ON position when the vehicle power is on and the engine is not running shall activate the starter motor aural cue.

(j) PANEL LIGHTS indicators/switches shall function as described:

i. TEST switch - When vehicle master power is on, pressing this pushbutton shall set all driver’s compartment panel indicators (DIP, DMP and DAP) and gauge illuminators to full brightness for as long as the button is pressed.

ii. Panel Light control - This switch is a potentiometer assembly which shall control the brightness of all indicators and internal gauge illuminators on the Driver’s Instrument panel (except for the ENGINE FIRE indicator), Driver’s Master panel, Driver’s Alert panel (when PNL DIM switch is pressed). When vehicle master power is cycled from off to on, the brightness shall be reset to full intensity.

(6) Driver’s Alert panel shall be functionally and physically replicated. The following switches and indicators on the Driver’s Alert panel shall be replicated and function as described:

(a) MASTER CAUTION indicator - This amber indicator shall be one discrete output and illuminated whenever the vehicle master power is on and any of the amber caution indicators in the Driver’s compartment are illuminated or a lamp test is performed.

(b) PNL DIM switch - This switch shall be a pushbutton and depressing this switch when vehicle master power is on shall cause the brightness of the Master Caution and Master Warning indicators to be controlled by the adjustment of the Panel Lights control.

(c) RESET switch - This switch shall be a pushbutton and pressing this switch when Master Caution indicator is illuminated shall extinguish all amber caution indicators. The Master Warning indicator shall be extinguished when the Reset button is pressed if it was illuminated by the Engine Overspeed or Engine Gas Overtemp indicators.

(d) MASTER WARNING indicator - This red indicator shall be one discrete output and illuminated whenever vehicle master power is on and any red warning indicators in driver compartment are illuminated or when a lamp test is performed. When the Master Warning indicator is illuminated due to the Engine Overspeed or Engine Gas Overtemp indicators, the Reset button must be pressed to extinguish the Master Warning indicator.

(7) Driver's Night Vision Viewer (NVV) - shall be simulated version of the AN/VVS-2 NVV and shall interface to the visual system. Installing the simulated NVV shall cause the visual system to display a graphical night vision replication of the surrounding terrain which shall be presented whenever simulated power is available to the viewer. The driver shall be able to install and remove the driver's night viewer.

(a) Off-Bright Knob - shall be an active control which shall simulate the removal of power from the NVV when in the OFF position (rotated fully counter-clockwise) and shall increase the level of brightness of the driver's NVV when the potentiometer is rotated clockwise.

(b) Power Jack - shall be a connector which allows connection of the Driver's Night Vision Viewer to the vehicle power. The status of this connection shall be used to determine whether display of night vision or normal vision terrain is to be simulated.

(c) NVV storage - A trainer unique stowage location shall be provided in the driver compartment.

(d) NVV Rotate - shall be a trainer unique active control that shall simulate slewing the NVV imagery +/- 45 degrees in azimuth.

(8) Intercom/Radio Box - shall be functionally replicated. The following switches and indicators on the Intercom/Radio box shall be replicated and function as described:

(a) Monitor switch - This switch shall be a 5-position rotary switch. Active switch positions shall be labeled "ALL", "A", "INT ONLY", "B" and "C".

(b) Volume control - This switch shall be one potentiometer which shall control the sound volume.

(c) Left connector (J803) shall allow for connection of an actual CVC helmet. The left connector shall also be used to detect the rear (intercom) CVC helmet switch position.

(d) Right connector (J802) shall allow for connection of an actual CVC helmet. The right connector shall also be used to detect the forward (radio) CVC helmet switch position and interface to the CVC helmet microphone and earphones (for both simulated intercom and radio).

(e) Remote cable - This cable shall be a dummy cable representing the interconnect of the driver's intercom switches on the Steering/Throttle control (T-Bar) to the Intercom Control Box.

(9) Domelight assembly - shall be functionally replicated as described:

(a) Domelight lamp shall be a bright light capable of illuminating driver's position.

(b) On/off brightness control shall be a potentiometer with a switch and shall control the level of brightness of the domelight lamp.

(10) Deleted

(11) Deleted

(12) Hatch Opening Crank - shall be provided as a space constraint (except for the handcrank).

(13) Deleted

(14) Driver's Seat - shall be functionally replicated. The seat shall have a full range of motion and adjustments except for the ability to move the seat into the open hatch position. The seat shall function as follows:

(a) Seat Height Control Lever - shall allow for adjustment of seat height,

(b) Upper Seat Back Lever - shall allow for adjustment of upper seat back,

(c) Deleted

(d) Seat manual control lever shall not be functional.

(e) The seat shall be capable of simulating vehicle vibrations via an embedded speaker or transducer as specified in H.30.1.1.7.6.

(15) Driver's Headrest - shall be functionally replicated. The headrest shall have a full range of motion and adjustments. Adjustment controls shall be as follows.

(a) Headrest adjustment knob.

(b) Headrest Spring Latch.

(16) Driver's Periscopes - Three vision blocks (periscopes) shall be provided to the driver which shall display scenes generated by the visual system as specified in Appendix A.

(a) Periscope adjustment knobs - These knobs are located on either side of the driver's periscopes and shall be physically and functionally replicated. When loosened, they allow the mirror on the periscope to be adjusted.

(17) Driver's NBC hookups are as follows:

(a) Mask air duct socket shall be physically and functionally replicated.

(b) Cooling Vest air duct socket shall be physically replicated.

(c) Cooling Vest air duct socket cap shall be physically and functionally replicated.

(18) Driver's Head Tracker - is a trainer unique item which shall provide feedback indicating where driver's head is located and shall be used for vision block control in the driver's periscopes.

(19) Driver's Condition indicator - shall be a trainer unique 2 lamp assembly. An amber lamp shall be illuminated when the driver is considered to be wounded; a red lamp shall be illuminated when the driver is considered dead.

(20) Driver's Parking Brake System Hydraulic Pressure Gauge - shall be functionally replicated, shall indicate parking brake system hydraulic pressure, and shall have a range of 0 - 2000 psi.

(21) NVV Power Cable - shall be functionally replicated. The cable shall interface with the power receptacle on the simulated NVV.

(22) NVV Power Cable Stowage receptacle - shall be physically replicated and shall interface with the NVV power cable for stowage.

30.1.2.2 Turret Compartment.

30.1.2.2.1 Tank Commander's Station.

The following controls, switches, gauges, and lights shall be provided at the Tank commander's station in the locations and panels as found in the actual M1A1.

a. The following controls, indicators, and other pieces of equipment shall be simulated (functional):

(1) Tank commander's panel shall contain operational and functional components as follows: All indicators shall light when PANEL LIGHTS TEST pushbutton is pressed.

(a) VEHICLE MASTER POWER shall be functionally replicated as follows:

i. VEHICLE MASTER POWER light shall be a green dome lamp and shall illuminate when power is on in tank electrical system.

ii. VEHICLE MASTER POWER switch shall be three position toggle switch momentary to the up and down positions and shall turn vehicle electrical power on and off.

(b) TURRET POWER shall be functionally replicated as follows:

i. TURRET POWER light shall be a green dome lamp and shall illuminate when turret electrical power is on.

ii. TURRET POWER switch shall be a three position toggle switch momentary to the up and down positions and shall turn electrical power to the turret on and off. Turret power shall automatically reset to off if vehicle power is lost. This switch shall also turn vehicle master power on.

(c) MANUAL RANGE shall be functionally replicated as follows:

i. MANUAL RANGE BATTLE SGT switch shall be a black pushbutton with skirt and shall direct the ballistic computer to use a preset range value for selected ammunition instead of automatic range inputs.

ii. ADD/DROP switch shall be a three position toggle switch and shall increment the selected range value when toggled to the up position and shall decrement the selected range value when toggled to the down position.

(d) AUX HYDR POWER shall be functionally replicated as follows:

i. AUX HYDR POWER indicator shall be a green dome lamp which indicates that auxiliary hydraulic power is applied.

ii. AUX HYDR POWER switch shall be a three position toggle switch and shall turn on auxiliary hydraulic power when toggled to the up position (ON) or shall turn off auxiliary power when toggled to the down position (OFF).

(e) GRENADES shall be functionally replicated as follows:

i. GRENADES SALVO 1 switch shall be a red pushbutton switch with a black skirt and shall launch six grenades, three from each side, if the grenade firing circuit is armed.

ii. GRENADES SALVO 2 switch shall be a red pushbutton switch with a black skirt and shall launch six grenades, three from each side, if the grenade firing circuit is armed.

iii. GRENADES READY/SAFE switch shall be a two position toggle switch and shall arm the grenade firing circuit in the “READY” position and shall disarm the grenade firing circuit in the “SAFE” position.

(f) PANEL LIGHTS shall be functionally replicated as follows:

i. PANEL LIGHTS TEST switch shall be a black pushbutton switch with a black skirt and shall light all commander’s panel indicators when this switch is pressed.

ii. PANEL LIGHTS TEST knob shall be a potentiometer and shall control the brightness level of all panel indicators.

(g) WARNING lights shall be functionally replicated as follows:

i. ENGINE FIRE lamp shall be a red dome indicator and shall illuminate when there is an engine fire or the panel light test button is pressed.

ii. CKT BKR OPEN lamp shall be a yellow dome indicator and shall illuminate when a virtual/active circuit breaker in the turret of the vehicle is in the “OFF” position or the panel light test button is pressed.

iii. FIRE CONTROL malfunction lamp shall be a red dome indicator and shall illuminate when a failure occurs in the fire control system, or the panel light test button is pressed.

iv. LOW BAT CHG lamp shall be a yellow dome indicator and shall illuminate when the battery charge is low or the panel light test button is pressed.

(h) NBC MODE shall be functionally replicated as follows:

i. NBC MAIN MODE shall function only while the engine is operating. The NBC MAIN mode shall only function to operate the NBC MAIN blower. The blower used by the NBC main mode shall be the same blower that is used by the NBC backup mode. MAIN switches/indicators shall function as described:

1. ON lamp shall be a green dome indicator and shall illuminate when the NBC main mode is on (indicating only that the blower is on) or the panel light test button is pressed.

2. NBC MODE MAIN switch shall be a three position toggle switch momentary to the up and down positions and shall control NBC MAIN MODE. Moving the switch to the on position shall only cause the blower to turn on, the ON lamp to illuminate, and the OFF lamp to turn off. Moving the switch to the off position shall only cause the blower to turn off, the OFF lamp to turn on, and the ON lamp to turn off.

3. OFF lamp shall be a red dome indicator and shall illuminate when the NBC main mode is off (indicating only that the blower is turned off) or the panel light test button is pressed.

ii. NBC BACKUP MODE shall only function to operate the NBC BACKUP blower. The blower used by the NBC mode backup shall be the same blower that is used by the NBC main mode.

1. ON lamp shall be a green dome indicator and shall illuminate when the NBC backup mode is on (indicating only that the blower is on) or the panel light test button is pressed.

2. NBC MODE BACKUP switch shall be a three position toggle switch momentary to the up and down positions and shall control NBC BACKUP MODE. Moving the switch to the on position shall cause the blower to turn on, the ON lamp to illuminate, and the OFF lamp to turn off. Moving the switch to the off position shall cause the blower to turn off, the OFF lamp to turn on, and the ON lamp to turn off.

3. OFF lamp shall be a red dome indicator and shall illuminate when the NBC backup mode is off (indicating only that the blower is off) or the panel light test button is pressed.

(i) AIR TEMP WARMER/COOLER shall be physically and functionally replicated with the exception that it will not affect air temperature.

(j) NBC ALARM switches/indicators shall function as described:

i. CHEMICAL lamp shall be a red dome indicator and shall illuminate when the light test button is pressed or under independent software control.

ii. NUCLEAR lamp shall be a red dome indicator and shall illuminate when the light test button is pressed or under independent software control.

iii. ALARM MUTE switch shall be physically replicated.

(k) NBC WARNING indicators shall function as described:

i. CREW PRESS LOW lamp shall be a yellow dome indicator and shall illuminate when the light test button is pressed or under independent software control.

ii. FILTER CLOGGED lamp shall be a yellow dome indicator and shall illuminate when the light test button is pressed or under independent software control.

iii. OVERHEAT SPONSON IN lamp shall be a yellow dome indicator and shall illuminate when the light test button is pressed or under independent software control.

iv. OVERHEAT SPONSON OUT lamp shall be a yellow dome indicator and shall illuminate when the light test button is pressed or under independent software control.

(2) Intercom/radio box shall be functionally replicated. The following switches, connectors and controls shall be replicated and function as described:

(a) MONITOR switch shall be a five position rotary switch. Active switch positions shall be labeled “ALL”, “A”, “INT ONLY”, “B” and “C”.

(b) VOLUME control shall be one potentiometer and shall control the sound volume.

(c) Left connector (J803) shall allow for connection of an actual CVC helmet. The left connector shall also be used to detect the rear (intercom) CVC helmet switch position.

(d) Right connector (J802) shall allow for connection of an actual CVC helmet. The right connector shall also be used to detect the forward (radio) CVC helmet switch position and interface to the CVC helmet microphone and earphones (for both simulated intercom and radio).

(e) Remote cable - This cable shall be a dummy cable representing the interconnect of the commander’s intercom switches on the CWS power control handle to the Intercom Control Box.

(3) Domelight shall function as described:

(a) Domelight lamp shall be a light capable of illuminating commander's position.

(b) On/off brightness control shall be a potentiometer with a switch and shall control the level of brightness of the domelight lamp.

(4) Commander's power control handle (TCH) shall be functionally replicated. The TCH shall control main gun elevation and turret traverse during powered operation. Button on handle shall control laser rangefinder and trigger shall fire main gun or coaxial machine gun. Traverse throw shall be +/- 91 degrees +/- 5 degrees. Elevation throw shall be 28 degrees +/- 4 degrees. Depression throw shall be 30 degrees +/- 4 degrees. Elevation rate versus handle deflection shall be as follows:

(a) Elevation rate versus handle deflection shall be as follows:

An elevation rate of 0.0 +/- 0.0 mils/second for a deflection of 0.0 degrees. An elevation rate of 0.0 +/- 1.0 mils/second for a deflection of 2.8 degrees. An elevation rate of 24.3 +/- 2.4 mils/second for a deflection of 19.6 degrees. An elevation rate of 44.5 +/- 4.5 mils/second for a deflection of 21.2 degrees. An elevation rate of 450.0 +/- 45.0 mils/second for a deflection of 30.0 degrees.

(b) The elevation rate plotted as a function of handle deflection shall be linear (constant slope) between the breakpoints specified above. The tolerance for elevation rates between the breakpoints specified above is +/- 10 % of the expected elevation rate.

(c) A traverse rate of 0.0 +/- 0.0 mils/second for deflection of 0.0 degrees. A traverse rate of 0.0 +/- 1.0 mils/second for deflection of 1.7 degrees. A traverse rate of 20.4 +/- 2.0 mils/second for deflection of 30.0 degrees. A traverse rate of 48.2 +/- 3.5 mils/second for deflection of 34.5 degrees. A traverse rate of 750.0 +/- 75.0 mils/second for deflection of 90.0 degrees.

(d) The traverse rate plotted as a function of handle deflection shall be linear (constant slope) between the breakpoints specified above. The tolerance for traverse rates between the breakpoints specified above is +/- 10 % of the expected traverse rate.

(e) TCH neutral position shall be within +/- 2 degrees of mechanical center. The switches shall return to normal (de-energized) position when the force on the switch is removed.

1. Palm switch shall be a pushbutton switch and shall remove control of turret from gunner's handles and shall give control to the commander. Squeezing the palm switch shall also start the stabilization system if GPS FIRE CONTROL MODE switch is in NORMAL.

2. Laser pushbutton shall operate laser rangefinder.

3. Trigger shall fire the main gun or coaxial machinegun.

4. Left/right deflection shall control turret azimuth movement.

5. Elevation/depression deflection shall control gun elevation movement.

(5) Commander's GPS extension shall display scenes as generated by the visual system as specified in Appendix A. The GPS shall show tank commander the target, gun sighting view and data.

(a) A sensor shall be provided to determine when the sight is in use and when activated, the GPS extension sight shall display simulated GPS imagery. Browpad shall have an adjusting screw.

(b) Diopter adjustment shall allow for simulated focusing of the GPS extension eyepiece on reticle pattern.

(6) Commander's weapon station (CWS) shall be functionally simulated. The following switches and indicators on the CWS shall be replicated and function as described:

(a) The 0.50 caliber machine gun ammo supply, load and unload functions as follows:

i. ROUNDS IN STORAGE - shall be a trainer unique panel used to monitor the storage and control the removal of ammo rounds from the 0.50 caliber ammo storage area. The following components shall be provided:

1. ROUNDS IN STORAGE shall be a 4 digit display that indicates the simulated number of ammo rounds in the ammo storage area.

2. FILL WEAPON AMMUNITION BOX shall be a pushbutton switch that initiates the simulated transfer of rounds from the storage area to the 0.50 caliber machine gun ammunition box.

ii. ROUNDS IN AMMUNITION BOX - shall be trainer unique panel indicating the number of rounds in the ammunition box.

iii. MACHINE GUN - shall be a trainer unique panel used to control and monitor the loading and unloading of the 0.50 caliber machine gun. The following components shall be provided:

1. LOAD/UNLOAD shall be a pushbutton switch that when depressed shall initiate the loading of the 0.50 caliber machine gun if unloaded or unload the 0.50 caliber machine gun if loaded.

2. LOADED indicator shall be a green indicator that illuminates when the 0.50 caliber machine gun is loaded. The indicator shall flash during the simulated unload time.

3. UNLOADED indicator shall be a green indicator that illuminates when the 0.50 caliber machine gun is unloaded. The indicator shall flash during the simulated unload time.

(b) CWS sight shall display scenes as generated by the visual system as specified in Appendix A. A sensor shall be provided to determine when the sight is in use and when activated, the CWS sight shall display simulated CWS imagery.

(c) CWS manual traverse ring shall be functionally replicated and shall traverse commander's weapon station during manual operation.

i. Traverse range shall be 360 degrees and shall continually rotate without limit.

(d) CWS elevation crank handle shall include a button on the handle for weapon firing and shall control manual elevation of commander's weapon. The elevation handle shall be activated in both power and manual modes of operation.

i. Elevation and depression limits shall be 65 degrees +/- 2 degrees and 10 degrees +/- 2 degrees, respectively.

ii. Caliber .50 elevation/depression rate shall be 71 mils/revolution +/- 5%.

(e) CWS safety switch shall function as described:

i. SAFE/ARMED switch shall be a three position lever locked momentary toggle switch that must be pulled to go into the "ARMED" positions. The switch shall return to the center position from either the "ARMED" or "SAFE" positions when released. The positions ARMED, center and SAFE shall be active. When set to right (ARMED) position, the weapon firing circuit shall be armed. When set to left (SAFE) position, the weapon firing circuit shall be disarmed.

ii. ARMED lamp shall be a red dome light and shall illuminate when commander's weapon is armed or shall illuminate when PANEL LIGHTS TEST pushbutton on commander's panel is pressed.

(f) CWS motor/brake assembly shall be physically and functionally replicated. This motor/brake assembly shall also provide the aural cues for commander's cupola movement.

(g) CWS Power Control Unit (PCU) shall be functionally but not physically replicated.

(h) CWS Power Control Handle shall be functionally replicated and contain operational and functional components described below. This handle shall traverse commander's weapon station during power operation when palm switch is depressed and thumb control on handle is moved. The maximum CWS traverse speed shall be 450 mils/sec, +/- 50 mils/sec. The CWS traverse speed shall be variable from 0 mils/sec to the maximum speed based on thumb control deflection.

i. DELETE

ii. DELETE

iii. DELETE

iv. DELETE

v. DELETE

vi. Palm switch shall be physically and functionally replicated.

vii. Thumb control on handle shall be physically and functionally replicated.

viii. Intercom/radio switch shall enable the commander to talk over the communications subsystem without removing his hands from the power control handle.

(7) Commander's seat assembly shall replicate the actual M1A1 commander's seat including full range of motion and adjustments. The seat shall function as follows:

(a) Footrest bar - shall be capable of being placed in the stowed and non-stowed positions.

(b) Height adjustment knob - shall allow for adjustment of seat height.

(c) The seat shall have the capability of simulating vehicle vibrations via an embedded speaker or transducer as specified in H.30.1.1.7.6.

(8) Commander's lower platform shall be physically and functionally replicated.

(9) MANUAL/POWER lever shall be a two position handle assembly with active positions labeled "MANUAL" and "POWER". This lever shall select powered or manual azimuth operation of CWS.

(10) Tank Commander’s condition indicator - shall be a trainer unique 2 lamp assembly. An amber lamp shall be illuminated when the tank commander is considered to be wounded; a red lamp shall be illuminated when the tank commander is considered dead.

(11) Commander’s NBC hookups are as follows:

(a) Mask air duct socket shall be physically and functionally replicated.
(b) Cooling Vest air duct socket shall be physically replicated.
(c) Cooling Vest air duct socket cap shall be physically and functionally replicated.

(12) Commander’s head tracker is a trainer unique item which shall provide feedback indicating where commander’s head is located and shall be used for vision block control in the commander’s cupola.

(13) Commander’s arm guard shall be physically and functionally replicated. The following related items will be replicated as follows:

(a) Hook shall be physically and functionally replicated.

(b) Latch shall be physically and functionally replicated.

(14) Commander’s knee guard shall be physically and functionally replicated.

(15) Commander’s arm rest/oddment box shall be physically replicated but shall not open.

(16) Commander’s Vision Blocks - 6 vision blocks (periscopes) shall be provided to the commander which shall display scenes generated by the visual system as specified in Appendix A.

(17) Commanders Hatch Assembly (Hatch cover, handle). For the Commander’s Popped Hatch (CPH) version, the hatch cap, when closed, shall be able to be opened by handles. A hinging mechanism shall cause the cap to move to an opening of approximately four inches (this spacing shall replicate the actual vehicle). The popped hatch view shall cover a 360-degree field of view and shall be obstructed by structures replicating the vision block housings, machine gun mounts, commander’s weapon sight tube, hatch hinge mechanisms, and a modified machine gun; when the cap is closed the module vision blocks shall use the same monitors to the same degree as in popped hatch mode.

(18) Control-Monitor shall replicate the actual C-11291/VRC Control-Monitor used with SINCGARS in the operational M1A1 as follows:

(a) RADIO switch - shall be a three position rotary switch. The “1” and “2”positions shall be active. The “1” position shall enable control of settings on SINCGARS RT-A. The “2” position shall enable control of setting on SINCGARS RT-B. The “3” position shall have no effect.

(b) FCTN switch - shall be a seven position rotary switch with the following positions:

i. TEST - shall cause the Control-Monitor to display normal (non-failed) self test indications on the digital displays.

ii. RF - shall enable the selection of RF power level of the currently selected RT. The selectable values for the RF power level shall be low, medium, high, and power amplified. The selected value shall change when the INIT switch is activated

iii. RT MODE - shall enable the selection of the radio channel of the currently selected RT. The selectable values for mode shall be Off, Single-Channel, Frequency-Hopping, and Frequency Hopping Master. The selected value shall change when the INIT switch is activated.

iv. CHAN - shall enable the selection of the radio channel of the currently selected RT. The selectable values for channel shall be Man, Cue, 1, 2, 3, 4, 5 , and 6. The selected value shall change when the INIT switch is activated.

v. VAR - shall enable the selection of the active COMSEC variable of the currently selected RT. The selectable values for COMSEC mode shall be plain-text and cipher text. The selected value shall change when the INIT switch is activated.

vi. COMSEC - shall enable the selection of active COMSEC mode of the currently selected RT. The selectable values for COMSEC mode shall be plain text and cipher text.

vii. CONTROL - shall be non-functional.

(c) INIT switch - shall be a three position toggle switch, spring loaded to the center position. When moved to the UP position, the switch shall increase the value of the setting currently selected by the FCTN switch. When moved to the DN position, the switch shall decrease the value of the setting currently selected by the FCTN switch.

(d) DIM knob - shall be a rotational knob used to control the brightness of the LED displays of the Control-Monitor.

(e) RT MODE display - shall be a red LED display which shall display an illuminated marker adjacent to the current mode of the RT selected by the RADIO switch.

(f) RF power display - shall be a red LED which shall display an illuminated marker adjacent to the current RF power level of the RT selected.

(g) CHAN display - shall be a red, single character, 7-segment LED display which displays the characters 0, 1, 2, 3, 4, 5, 6, and C according to the current radio channel of the RT selected by the RADIO switch. The CHAN display shall also be capable of displaying the characters “F”, “G”, and “U” during the Control-Monitor self-test function.

(h) COMSEC/CONTROL mode display - shall be a red LED which shall display an illuminated marker adjacent to the current COMSEC mode of the RT selected by the radio switch. The CONTROL mode portion of the display shall display an illuminated marker adjacent to the “m” label.

(19) Commander’s Curtain Assembly - shall be physically replicated.

(20) Precision Lightweight GPS Receiver (PLGR+96 SPS) shall be physically installed as in the operational unit, except where simulated vehicle space constraints apply and functionally replicated as described in paragraph 3.7.6.4.

30.1.2.2.2 Gunner’s Station.

The following controls, switches, gauges, and lights shall be provided at the Gunner’s station in the locations and panels as found in the actual M1A1.

a. The following controls, indicators, and other pieces of equipment shall be simulated (functional):

(1) Gunner’s Power Control handles (GCH) shall contain the following operational and functional components. Traverse throw shall be +/- 91 degrees +/- 5 degrees. Elevation and depression throw shall be +/- 30 degrees +/- 3 degrees. Elevation and traverse rates versus handle deflection shall be same as commander’s control handle. TCH neutral position shall be within +/- 2 degrees of mechanical center. The switches shall return to normal (de-energized) position when the force on the switch is removed.

(a) Palm switches shall function as follows:

i. Left palm switch shall be physically and functionally replicated.

ii. Right palm switch shall be physically and functionally replicated.

(b) Trigger switches shall function as follows:

i. Left trigger switch shall be a red pushbutton switch. Squeezing this switch with gunner's station powered up and either palm switch depressed shall fire main gun or coaxial machine.

ii. Right trigger switch shall be a red pushbutton switch. Squeezing this switch with gunner's station powered up and either palm switch depressed shall fire main gun or coaxial machine.

(c) Laser switches shall function as follows:

i. Left laser switch shall be a red pushbutton switch. Pressing this switch with gunner's station powered up and either palm switch depressed shall operate laser rangefinder.

ii. Right laser switch shall be a red pushbutton switch. Pressing this switch with gunner's station powered up and either palm switch depressed shall operate laser rangefinder.

(d) Power elevation and traverse shall be simulated as follows:

i Rotating gunner's handles backward shall elevate weapons. Rotating gunner's handles forward shall depress weapons.

ii Rotating gunner's handles clockwise shall traverse turret right. Rotating gunner's handles counterclockwise shall traverse turret left.

(e) Manual elevation shall be simulated as follows:

i. Cranking manual elevation handle clockwise shall elevate main gun and coaxial machinegun Cranking handle counterclockwise shall lower main gun and machinegun. The manual elevation assembly shall drive the simulated gun at a rate of 10.175 mils +/- 5% per revolution of the handcrank. With main gun pointed to the front of the vehicle, gun depression shall be limited to 10 degrees. Gun elevation shall be limited to 20 degrees for 360 degrees turret travel while operating the manual elevation handle assembly.

ii. Squeezing palm switch shall allow for rotation of manual elevation handle.

iii. Emergency trigger shall be a red pushbutton switch and shall fire main gun or machine gun in the normal, emergency, or manual mode of operation.

(f) Manual traverse shall be simulated as follows:

i. Cranking manual traverse handle clockwise shall traverse turret right. Cranking handle counterclockwise shall traverse turret left. Nominal rates of 5 and 10 mils per crank revolution shall be simulated. One revolution of the hand traverse crank shall rotate the turret 10.561 mils +/- 5% when the 10 mil rate is selected and 5.28 mils +/- 5% when the 5 mil rate is selected. The manual handcrank shall provide 360 degrees of simulated turret traverse rotation.

ii. Squeezing palm switch shall allow for rotation of manual drive handle.

iii. Blasting machine shall be physically and functionally replicated.

(2) Gunner's Primary Sight (GPS) shall contain operational and functional components as follows:

(a) GPS eyepiece shall display scenes generated by the visual system as specified in Appendix A.

i. Diopter adjustment shall allow for simulated focusing of the GPS extension eyepiece on reticle pattern.

ii. A sensor shall be provided to determine when the sight is in use and when activated, the GPS sight shall display simulated GPS imagery. Browpad shall have an adjusting thumbscrew and shall have left and right holding grooves.

(b) GPS upper panel assembly shall contain operational and functional components as follows:

i. FIRE CONTROL MODE switch shall be a three position magnetically held (EMERGENCY and MANUAL positions) toggle switch. Active switch positions shall be labeled "NORMAL", "EMERGENCY" and "MANUAL".

ii. FIRE CONTROL MODE lights shall be simulated as follows:

1. EMERGENCY lamp shall be an amber dome light and shall illuminate when FIRE CONTROL MODE switch is set to the EMERGENCY position or PANEL LIGHTS TEST pushbutton is pressed.

2. NORMAL lamp shall be a green dome light and shall illuminate when FIRE CONTROL MODE switch is set to the NORMAL position or PANEL LIGHTS TEST pushbutton is pressed.

3 MANUAL lamp shall be a white dome light and shall illuminate when FIRE CONTROL MODE switch is set to the MANUAL position or PANEL LIGHTS TEST pushbutton is pressed.

iii. PANEL LIGHTS TEST switch shall be a black pushbutton switch with skirt and shall turn on all GPS and Thermal Imaging System (TIS) indicator lights to full brightness.

iv. PANEL LIGHTS control shall be a potentiometer for lamp dimming and shall control brightness of GPS (upper and lower panels) and TIS indicator lights.

v. MRS OUT/IN lever shall be a two position lever assembly with active positions “OUT” and “IN” and shall control mirror that allows Muzzle Reference Sensor (MRS) reticle to appear in GPS optical system.

vi. DEFROSTER switch shall be a mechanical control which replicates the appearance and movement of the corresponding actual control. This control shall be non-functional.

vii. DEFROSTER lamp shall be a green dome lamp and shall illuminate only when PANEL LIGHTS TEST pushbutton is pressed.

viii. RETICLE knob shall be a mechanical control which replicates the appearance and movement of the corresponding actual control. This control shall adjust brightness of the GPS reticle.

ix. Unity window shall display scenes generated by the visual system as specified in Appendix A.

x. GPS ballistic door handles shall be replicated and function as follows:

1. DAY handle shall be a two position handle assembly with “DAY” written on the handle and shall simulate opening the left ballistic door by squeezing finger lever on top and turning clockwise.

2. THERMAL handle shall be a two position handle assembly with “THERMAL” written on the handle and shall simulate opening the right ballistic door by squeezing finger lever on top and turning counterclockwise.

(c) GPS lower panel assembly shall contain operational and functional components as follows:

i. NORMAL MODE DRIFT AZ knob shall correct for turret azimuth drift in stabilized (normal) sighting system. This knob shall have “PUSH TO TURN” written on it in white letters.

ii. NORMAL MODE DRIFT EL knob shall correct for elevation drift in stabilized (normal) sighting system. This knob shall have “PUSH TO TURN” written on the it in white letters.

iii. FLTR/CLEAR/SHTR switch shall be a three position 120 degree rotary switch and shall have a pointer knob with active positions labeled “FLTR”, “CLEAR”, and “SHTR”. This switch shall position clear window or shutter in the GPS day optic system, and shall have no effect in the filter position.

iv. GUN SELECT switch shall be a three position magnetically held (MAIN and COAX positions) toggle switch with active positions labeled “MAIN”, “SAFE” and “COAX”. This switch shall select main gun or coaxial machine gun firing circuit for firing or trigger safe so neither gun will fire. Switch shall reset to safe when power is turned off. If switch is set to COAX with engine running, the NBC main system shall turn on (blower only).

v. GUN SELECT lamps shall be simulated as follows:

1. MAIN lamp shall be a green dome lamp and shall illuminate when GUN SELECT switch is set to MAIN or PANEL LIGHTS TEST pushbutton is pressed.

2. TRIGGER SAFE lamp shall be a white dome lamp and shall illuminate when GUN SELECT switch is in the SAFE position or PANEL LIGHTS TEST pushbutton is pressed.

3. COAX lamp shall be a green dome lamp and shall illuminate when GUNSELECT switch is set to COAX or PANEL LIGHTS TEST pushbutton is pressed.

vi. AMMUNITION SELECT switch shall be a four position rotary switch with positions labeled “SABOT”, “MPAT”, “STAFF”, and “HEAT”. This switch shall input ammunition (SABOT or HEAT) type data into the ballistic computer when GUN SELECT switch is set to MAIN or trigger SAFE. The “MPAT” and “STAFF” positions shall be non-functional.

vii. AMMUNITION SELECT lamps shall be simulated as follows:

1. SABOT lamp shall be a green dome lamp and shall illuminate when AMMUNITION SELECT switch is set to SABOT and GUN SELECT switch is set to MAIN or TRIGGER SAFE. This lamp shall also illuminate if PANEL LIGHTS TEST pushbutton is pressed.

2. HEAT lamp shall be a green dome lamp and shall illuminate when AMMUNITION SELECT switch is set to HEAT and GUN SELECT switch is set to MAIN or TRIGGER SAFE. This lamp shall also illuminate if PANEL LIGHTS TEST pushbutton is pressed.

3. MPAT lamp shall be non-functional.

4. STAFF lamp shall be non-functional.

viii. MAGNIFICATION switch shall be a two position lever assembly with positions “3X” and “10X” active. This switch shall select optical 3X or 10X magnification for GPS day optical system.

(d) Laser Rangefinder (LRF) shall contain operational and functional components as follows:

i. RANGE switch shall be a three position toggle switch with active positions labeled “SAFE”, “ARM 1ST RTN”, and “ARM LAST RTN”. This switch shall set first or last return, or safe mode of LRF. LRF shall return to safe when turret power is turned off, but switch shall not trip to safe position.

ii. Test shall be a dummy connector with cover.

(e) Image Control Unit (ICU) shall contain operational and functional components as follows:

i. CONTRAST shall adjust contrast of TIS image.

ii. POLARITY shall be a two position toggle switch with active positions labeled “WHITE HOT” and “BLACK HOT”. This switch shall select white or black presentation of hot objects in TIS image.

iii. RETICLE shall be used to adjust reticle intensity from white to black in TIS image.

iv. TRU READY lamp shall be a green dome lamp and shall illuminate when thermal receiver is ready for operation or shall illuminate if PANEL LIGHTS TEST pushbutton is pressed.

v. FAULT lamp shall be a yellow dome lamp and shall illuminate if PANEL LIGHTS TEST pushbutton is pressed.

vi. SYMBOLS shall be used to adjust brightness of range, multiple returns, ready-to-fire symbol, and fire control fault “F” symbol in the GPS field of view. This knob shall be used for both day and TIS operation.

vii. SENSITIVITY shall adjust brightness of TIS image.

viii. THERMAL MODE shall be a three position toggle switch with active positions labeled “OFF”, “STBY”, and “ON”. This switch shall select OFF, ON, or STBY mode of TIS.

ix. THERMAL TEST UNIT TEST PATTERN shall be a five position rotary switch with active positions labeled “OFF”, “PCU”, “ICU”, “EU”’ and “TRU”. Each switch position, excluding OFF position, shall bring up a specific test pattern in the GPS.

x. BORESIGHT shall be replicated and function as follows:

1. AZ knob shall be a mechanical control which replicates the appearance and movement of the corresponding actual control. This control shall be non-functional.

2. EL knob shall be a mechanical control which replicates the appearance and movement of the corresponding actual control. This control shall be non-functional.

(f) Thermal Receiving Unit (TRU) shall contain operational and functional components as follows:

i. THERMAL MAGNIFICATION control shall be a two position lever assembly with “3X” and “10X” positions active. This lever shall select 3X or 10X magnification for TIS image.

ii. FOCUS control shall be mechanical control which replicates the appearance and movement of the corresponding actual control. This control shall be non-functional.

iii. ANTI-GLARE switch shall be a five position rotary switch with active positions labeled “1”, “2”, “3” , “4” and “5” and shall have a pointer knob. Position 1 shall be no filter; filter positions 2, 3, and 4 shall have no effect on thermal image; and position 5 shall be shutter and shall be used when TIS is in standby and off.

(3) Intercom/radio box shall be functionally replicated. The following switches, connectors, and controls shall be replicated and function as described:

(a) MONITOR switch shall be a five position rotary switch. Active switch positions shall be labeled “ALL”, “A”, “INT ONLY”, “B” and “C”.

(b) VOLUME control shall be one potentiometer which shall control the sound volume.

(c) Left connector (J803) shall allow for connection of an actual CVC helmet. The left connector shall also be used to detect the rear (intercom) CVC helmet switch position.

(d) Right connector (J802) shall allow for connection of an actual CVC helmet. The right connector shall also be used to detect the forward (radio) CVC helmet switch position and interface to the CVC helmet microphone and earphones (for both simulated intercom and radio).

(e) Gunner’s remote (foot) intercom switch shall enable the gunner to talk over the intercom.

(f) Remote cable - This cable shall be a dummy cable representing the interconnect of the gunner’s remote (foot) intercom switch to the Intercom Control Box.

(4) Domelight shall function as described:

(a) Domelight lamp shall be a bright light capable of illuminating gunner’s position.

(b) On/off brightness control shall be a potentiometer with a switch which shall be capable of controlling the level of brightness of the domelight lamp.

(5) Gunner’s Auxiliary Sight (GAS) shall contain operational and functional components as follows:

(a) A sensor shall be provided to determine when the sight is in use when activated, the GAS sight shall display simulated GAS imagery. Browpad shall have an adjusting screw and shall have left and right holding grooves.

(b) GAS browpad adjustment knob shall be physically and functionally replicated.

(c) Boresight AZ adjustment shall be a pictorial representation of the actual control. This control shall be non-functional.

(d) Boresight EL adjustment shall be a pictorial representation of the actual control. This control shall be non-functional.

(e) RETICLE select switch shall be a two position rotary switch with positions labeled “SABOT/STAFF” and “HEAT/MPAT” and shall have a pointer knob. This switch shall select between two separate focal plane ballistics reticles (SABOT and HEAT).

(f) Reticle brightness adjust shall adjust reticle to desired brightness.

(g) FILTER select switch shall be a two position rotary switch with “IN” and “OUT” positions active and shall have a pointer knob. Filter knob shall provide for normal viewing in both the IN (left) and OUT (right) positions.

(h) GAS eyepiece shall display scenes generated by the visual system as specified in Appendix A.

(j) Focus (diopter) ring adjustment shall allow for simulated focusing of the GAS eyepiece on reticle pattern.

(6) Computer Control Panel (CCP) shall contain operational and functional components as follows:

(a) TEST switch/lamp shall be a white square pushbutton with “TEST” engraved in black. When pressed with the proper conditions present, this switch shall initiate computer self test and lamp shall remain illuminated during entire test.

(b) NO GO lamp shall be a red flat lense lamp with “NO GO” engraved in black. This lamp shall illuminate in some instances during computer self test to indicate a failed system.

(c) AMMO TEMP switch/lamp shall be a white square pushbutton with “AMMO TEMP” engraved in black. Lamp shall illuminate when pushbutton is pressed. This pushbutton shall set computer for manual input of ammunition temperature data, and shall show previous data (if any) on display.

(d) AMMO SUBDES switch/lamp shall be a white square pushbutton with “AMMO SUBDES” engraved in black. With appropriate gun selection and ammunition selection made, the lamp shall illuminate when pushbutton is pressed; the lamp shall flash if AMMUNITION SELECT switch is changed after an ammunition dependent function is selected. This pushbutton shall set computer for manual input of ammunition subdesignation code, and shall show previous data (if any) on display.

(e) BS ADJUST switch/lamp shall be a white square pushbutton with “BS ADJUST” engraved in black. With appropriate gun selection and ammunition selection made, the lamp shall illuminate when pushbutton is pressed; the lamp shall flash if AMMUNITION SELECT switch is changed after an ammunition dependent function is selected. This pushbutton shall set computer for manual input of battle sight range data, and shall show previous data (if any) on display.

(f) MAINT DATA switch/lamp shall be a white square pushbutton with “MAINT DATA” engraved in black. This switch shall be used for unit maintenance only.

(g) ON-OFF switch shall be a two position toggle switch and shall turn CCP power on and off.

(h) PWR light shall be a green flat lense lamp with “PWR” engraved in white and shall illuminate when CCP is on.

(i) BARO PRESS switch/lamp shall be a white square pushbutton with “BARO PRESS” engraved in black. This pushbutton shall set computer for manual input of barometric pressure data, and shall show previous data (if any) on display.

(j) AIR TEMP switch/lamp shall be a white square pushbutton with “AIR TEMP” engraved in black. This pushbutton shall set computer for manual input of air temperature data, and shall show previous data (if any) on display.

(k) MRS switch/lamp shall be a white square pushbutton with “MRS” engraved in black. This pushbutton shall indicate that MRS is set in manual adjustment of fire control system and computer to compensate for gun tube droop.

(l) RANGE switch/lamp shall be a white square pushbutton with “RANGE” engraved in black. This pushbutton shall cancel automatic range data and set computer for manual range input and shall show previous data (if any) on display.

(m) LEAD switch/lamp shall be a white square pushbutton with “LEAD” engraved in black. This pushbutton shall cancel automatic lead data and set computer for manual input of lead data and shall show previous data (if any) on display.

(n) CANT switch/lamp shall be a white square pushbutton with “CANT” engraved in black. This pushbutton shall cancel automatic cant data and set computer for manual input of cant data and shall show previous data (if any) on display.

(o) CROSSWIND switch/lamp shall be a white square pushbutton with “CROSSWIND” engraved in black. This pushbutton shall cancel automatic crosswind data and set computer for manual input of crosswind data and shall show previous data (if any) on display.

(p) CCP display shall be a five character seven segment display capable of displaying decimal point to the left of each character. This display shall show previously stored information when input button is pressed and shall show new information entered using numbered pushbuttons or RETICLE ADJUST toggle switch. The display characters shall flash if input is higher or lower than preset limits.

(q) ZERO switch/lamp shall be a white square pushbutton with “ZERO” engraved in black. This pushbutton shall set computer for input of zero corrections for selected ammunition type.

(r) BORESIGHT switch/lamp shall be a white square pushbutton with “BORESIGHT” engraved in black. This pushbutton shall set computer for input of corrections.

(s) Keypad shall be consist of the following pushbutton switches and shall enter data on computer display after an input button is pressed:

i. Seven switch shall be a white square pushbutton switch with “7” engraved in black.

ii. Eight switch shall be a white square pushbutton switch with “8” engraved in black.

iii. Nine switch shall be a white square pushbutton switch with “9” engraved in black.

iv. Four switch shall be a white square pushbutton switch with “4” engraved in black.

v. Five switch shall be a white square pushbutton switch with “5” engraved in black.

vi. Six switch shall be a white square pushbutton switch with “6” engraved in black.

vii. One switch shall be a white square pushbutton switch with “1” engraved in black.

viii. Two switch shall be a white square pushbutton switch with “2” engraved in black.

ix. Three switch shall be a white square pushbutton switch with “3” engraved in black.

x. Decimal point switch shall be a white square pushbutton switch with “.” engraved in black.

xi. Zero switch shall be a white square pushbutton switch with “0” engraved in black.

xii. Dash switch shall be a white square pushbutton switch with “-” engraved in black.

(t) RETICLE ADJUST shall be a five position toggle switch spring loaded to center and shall have “U”, “D”, “L”, “R” and center positions active. This switch shall move GPS reticle up, right, down, or left during MRS correction operations.

(u) ENTER switch/lamp shall be a white rectangular pushbutton with “ENTER” engraved in black. This pushbutton shall enter data on computer display into computer memory for use in ballistic solutions.

(v) CLEAR switch/lamp shall be a white rectangular pushbutton with “CLEAR” engraved in black. This pushbutton shall clear display of any manual-entry numbers before ENTER pushbutton has been pushed; display shall reset to original numbers. CLEAR shall be also used to correct an incorrect manual entry, but must be used before ENTER pushbutton is pushed.

(w) LR indicator shall be a split legend two lamp white indicator with “L” and “R” engraved in black.

(x) UD indicator shall be a split legend two lamp white indicator with “U” and “D” engraved in black.

(y) Cover plate shall be a metal hinged protective cover covering the AMMO SUBDES, BS ADJUST and MAINT DATA pushbuttons.

(7) Gunner’s seat assembly shall replicate the actual M1A1 gunner’s seat and shall include the full range of motion and adjustments. The seat shall function as follows:

(a) Height adjustment lever - shall allow for adjustment of seat height.

(b) Forward/back adjusting lever - shall allow for adjustment in the forward and backward direction.

(c) The seat shall have the capability of simulating vehicle vibrations via an embedded speaker or transducer as specified in H.30.1.1.7.6.

(8) Gunner’s NBC hookups are as follows:

(a) Mask air duct socket shall be physically and functionally replicated.

(b) Cooling Vest air duct socket shall be physically replicated.

(c) Cooling Vest air duct socket cap shall be physically and functionally replicated.

(9) Gunner’s Condition indicator - shall be a trainer unique 2 lamp assembly. An amber lamp shall be illuminated when the gunner is considered to be wounded; a red lamp shall be illuminated when the gunner is considered dead.

(10) Hydraulic pressure gage is a mechanical control which replicates the appearance of the corresponding actual control. This control shall be non-functional.

(11) Deleted.

(12) Gunner's chest rest shall be functionally and physically replicated and shall have a chest rest adjustment knob.

(13) Coaxial machine gun charging cable shall be physically replicated. Activation of the handle shall clear a 7.62mm machine gun misfire.

(14) Spent ammunition box shall be a partial mock-up for a space constraint.

(15) Ammunition Temperature Guage - shall be a non-functional pictorial representation.

30.1.2.2.3 Loader's Station.

The following controls, switches, gauges, and lights shall be provided at the Loader's station in the locations and panels as found in the actual M1A1.

a. The following controls, indicators, and other pieces of equipment shall be simulated (functional):

(1) Loader's Panel (LP) shall contain operational and functional components as follows:

(a) MAIN GUN STATUS lights shall be functionally replicated as follows:

i. ARMED light shall be a yellow dome lamp and shall illuminate when main gun firing circuit is armed or when PANEL LIGHTS TEST pushbutton on commander's panel is pressed.

ii. SAFE light shall be a yellow dome lamp and shall illuminate when turret power is applied and main gun firing circuit is not armed or when PANEL LIGHTS TEST pushbutton on commander's panel is pressed.

(b) TURRET BLOWER switch shall be a two position switch with active positions labeled "ON" and "OFF". This switch shall provide the loader the ability to control the NBC MAIN system (turn on/off the blower) provided it is not already operating.

(c) GUN/TURRET DRIVE switch shall be a three position lock lever toggle switch with active positions labeled "EL UNCPL", "POWERED", and "MANUAL". This switch shall set gun and turret drive system to powered, manual, or elevation uncoupled mode.

(d) EL UNCPL light shall be a white dome lamp and shall illuminate when GUN/TURRET DRIVE switch is set to EL UNCPL position.

(e) POWERED light shall be a yellow dome lamp and shall illuminate when GUN/TURRET DRIVE switch is set to POWERED position. POWERED position shall allow gunner and tank commander to operate fire control system in stabilized mode.

(f) MANUAL light shall be a white dome light and shall illuminate when GUN/TURRET DRIVE switch is set to MANUAL.

(2) Knee switch shall be pushbutton activated knee guard switch. Actuation of the knee switch shall cause the ammo door to open (under normal conditions). Release of the knee switch shall cause the door to close. The Knee switch shall be capable of being stowed in up position.

(3) Ready ammunition door shall be functionally and physically replicated. The door shall automatically open and close when the ammunition door knee switch is activated. The weight of the door shall be less than that of the actual M1A1 ready ammunition door for safety reasons. Full door travel from closed to open shall take 1.5 seconds +/- 0.5 seconds and 2.0 seconds +/- 0.5 seconds from open to closed.

(a) Safety switch shall be an edge activated switch. This switch shall be capable of stopping the movement of the ready ammunition door.

(b) Door Closure assurance latch and lock shall be functionally but not physically replicated. The functionality of the lock and latch shall be simulated based upon the door position.

(c) Door closing actuator shall be functionally but not physically replicated. The door shall be opened and closed by a trainer unique actuator located behind the door.

(d) Door closing actuator release pin shall not be replicated.

(e) Door lockshaft shall not be replicated.

(f) Deleted

(4) Intercom/radio box shall be functionally replicated. The following switches, connectors, and controls shall be replicated and function as described:

(a) MONITOR switch shall be a five position rotary switch. Active switch positions shall be labeled “ALL”, “A”, “INT ONLY”, “B” and “C”.

(b) VOLUME control shall be one potentiometer which shall control the sound volume.

(c) Left connector (J803) shall allow for connection of an actual CVC helmet. The left connector shall also be used to detect the rear (intercom) CVC helmet switch position.

(d) Right connector (J802) shall allow connection of an actual CVC helmet. The right connector shall also be used to detect the forward (radio) CVC helmet switch position and interface to the CVC helmet microphone and earphones (for both simulated intercom and radio).

(e) Deleted

(f) Deleted

(5) Domelight shall function as described:

(a) Domelight lamp shall be a bright light capable of illuminating loader's position.

(b) On/off brightness control shall be a potentiometer with a switch which shall be capable of controlling the level of brightness of the domelight lamp.

(6) Loader's periscope shall rotate through 360 degrees and shall display scenes generated by the visual system as specified in Appendix A.

(a) Periscope adjustment knobs - These knobs are located on either side of the loader's periscopes and shall be physically and functionally replicated. When loosened, they allow the mirror on the periscope to be adjusted.

(b) Vertical Field-of-View (FOV) Switch - shall be a three position switch which controls the pitch of the loaders periscope FOV. The three positions shall move the Loader's vertical FOV up and down between -4.5 degrees and +4.5 degrees.

(7) The turret networks box shall be replicated, by providing, as a minimum, the circuit breaker panel as follows:

(a) Circuit breakers 3, 12, 19, and LAMP RESET shall be operational and functional.

(b) Deleted

(c) Placement of the circuit breaker panel within the crew compartment shall be exempt from the tolerance requirements of section 3.6.e.

(8) Audio frequency amplifier (AM 1780/VRC) shall be functionally replicated as follows:

(a) MAIN PWR switch shall be a three position rotary switch with pointer knob and shall have active positions labeled “NORM”, “INT ONLY” and “OFF”. No radio transmission shall be possible when MAIN PWR switch is in INT ONLY position. The entire communications system shall be turned off when MAIN PWR switch is in OFF position.

(b) INT ACCENT switch shall be two position rotary switch with pointer knob and active positions labeled “ON” and “OFF”. Intercom and radio sound levels shall be equal when INT ACCENT switch is set to OFF. Radio sound level shall be lower than intercom when INT ACCENT switch is set to ON.

(c) RADIO TRANS switch shall be a three position rotary switch with pointer knob and active positions labeled “CDR + CREW”, “CDR ONLY”, and “LISTENING SILENCE”. Entire crew shall be able to transmit on radio with RADIO TRANS switch in CDR + CREW position. Only tank commander shall be able to transmit on radio with RADIO TRANS switch in CDR ONLY position. No radio transmission shall be possible with RADIO TRANS switch in LISTENING SILENCE position.

(d) POWER CKT BKR switch shall be a two position trippable toggle type circuit breaker.

(e) POWER light shall be a lamp and shall indicate when power is applied to the communications system.

(f) INSTALLATION switch shall be a three position rotary switch requiring flat blade screwdriver to change switch setting and shall have active positions labeled “INT ONLY”, “OTHER”, and “RETRANS”.

(g) AUDIO INPUT jacks shall be functionally replicated as follows:

i. Left jack shall be non-operational and non-functional.

ii. Right jack shall be non-operational and non-functional.

(h) LINE jacks shall be functionally replicated as follows:

i. Left jack shall be non-operational and non-functional.

ii. Right jack shall be non-operational and non-functional.

(i) Amplifier cover shall be physically and functionally replicated.

(9) Two SINCGARS radios (RT-1523A) shall be functionally and physically replicated. The SINCGARS radios shall be compatible with organizational requirements, except as indicated in 3.7.6, for vehicle and headquarters radio configurations and shall allow for communication with the Operations Center (OC) and other desired units. Each radio shall simulate the following controls:

(a) ANT connector shall be a dummy 3-D connector which shall have a dummy cable. The long range (lower) radio shall connect to the RF power amplifier. The short range (upper) radio shall connect to the chassis (representing connecting to the vehicle antenna).

(b) CHAN (channel) switch shall select manual, preset and cue channels. This switch shall be an 8 - position rotary switch with pointer knob which utilizes the following positions:

i. CUE - This position shall allow the operator to preset SC frequency for the CUE channel or select the preset CUE frequency.

ii. MAN - This position shall allow the operator to preset SC frequency for the MAN channel or select the preset MAN frequency.

iii. 1 - This position shall allow the operator to preset a SC frequency for channel 1. This position shall also select the preset SC frequency when in SC mode and the FH hopset when in FH mode for channel 1. The loading of preset FH channels or COMSEC keys shall be simulated using the external interface unit.

iv. 2 - This position shall allow the operator to preset a SC frequency for channel 2. This position shall also select the preset SC frequency when in SC mode and the FH hopset when in FH mode for channel 2. The loading of preset FH channels or COMSEC keys shall be simulated using the external interface unit.

v. 3 - This position shall allow the operator to preset a SC frequency for channel 3. This position shall also select the preset SC frequency when in SC mode and the FH hopset when in FH mode for channel 3. The loading of preset FH channels or COMSEC keys shall be simulated using the external interface unit.

vi. 4 - This position shall allow the operator to preset a SC frequency for channel 4. This position shall also select the preset SC frequency when in SC mode and the FH hopset when in FH mode for channel 4. The loading of preset FH channels or COMSEC keys shall be simulated using the external interface unit.

vii. 5 - This position shall allow the operator to preset a SC frequency for channel 5. This position shall also select the preset SC frequency when in SC mode and the FH hopset when in FH mode for channel 5. The loading of preset FH channels or COMSEC keys shall be simulated using the external interface unit.

viii. 6 - This position shall allow the operator to preset a SC frequency for channel 6. This position shall also select the preset SC frequency when in SC mode and the FH hopset when in FH mode for channel 6. The loading of preset FH channels or COMSEC keys shall be simulated using the external interface unit.

(c) RF PWR switch shall be a 4 position rotary switch with pointer knob, with the following positions:

i. LO - This position shall set the transmission power to low.

ii. M - This position shall set the transmission power to medium.

iii. HI - This position shall set the transmission power to high.

iv. PA - This position shall set the operation of transmissions for use with the power amplifier, or high power if power amplifier is not connected to the RT.

(d) MODE Switch - This switch shall be a 3 - position rotary switch with pointer knob, with the following positions:

i. SC - This position shall set the Receiver/Transmitter to SC (single channel) mode.

ii. FH - This position shall set the Receiver/Transmitter to FH (frequency hopping) mode.

iii. FH-M - This position shall set the Receiver/Transmitter to FH-M (frequency hopping master) mode. The operator shall be required to pull the switch to go into the FH-M position.

(e) RXMT connector shall be a dummy 3-D connector which shall have a dummy cable connected to the RXMT on the other RT in the radio mount.

(f) FCTN (function) Switch - This switch shall be a 9 - position rotary switch with pointer knob, with the following positions:

i. STBY - This position shall turn off receiver/transmitter (RT) while maintaining memory. The operator shall be required to pull the switch knob in order to go into the STBY position.

ii. TST - This position shall cause the normal self test indications to be displayed on the keyboard display.

iii. LD - This position shall allow the operator to load SC frequencies, and shall also allow the operator to receive ERF data from an RT operating in FH-M mode.

iv. SQ ON - This position shall turn on the RT and activate the squelch.

v. SQ OFF - This position shall turn on the RT and deactivate the squelch.

vi. RXMT - This position shall be non-functional.

vii. REM - This position shall disable the RT's front panel controls.

vii. Z-FH - This position shall clear the RT of all FH data. The operator hall be required to pull the switch knob in order to go into the Z-FH position.

viii. OFF - This position shall turn off all power to the RT. This function shall also erase the RT's memory. The operator shall be required to pull the switch knob in order to go to the OFF position.

(g) DIM Control - This shall be an active control which replicates the appearance and function of the corresponding actual knob.

(h) Keyboard Display shall display all information concerning the operation of the RT including SC frequencies, FH data, error messages, data rates as well as keyboard entries. The display shall consist of 8 full 5 X 7 dot matrix characters that are alphanumeric with the capability to display special characters. The seventh 5 X 7 dot matrix character shall be capable of displaying no dots on column number one, on column number two only displaying dots on rows one, three, five, and seven that have the capability to be lighted individually, no dots on column number three, and capable of lighting all the dots on columns four and five at the same time. The eight dot matrix character shall also be capable of displaying dots arranged in the form of a diamond. All displays shall be dimmable. Color of display shall be green.

(i) Keypad shall be responsible for the entering data into the RT. The keypad shall consist of the following 16 pushbutton keys:

i. CMSC 1 - Shall display the COMSEC key identifier number on the display and enter the number '1' into the system.

ii. * 2 - Shall enter the number ’2’ into the system. The special feature activated by this key on the actual RT shall not be selectable or simulated.

iii. SYNC 3 - Shall place the RT into ’late entry’ status allowing the RT to re-enter the network. Also shall enter the number ’3’ into the system.

iv. FREQ - Shall allow the operator to load and clear SC frequencies in the RT.

v. DATA 4 - Shall display the RT’s operational data rate and enter the number ’4’ into the system.

vi. 5 - Shall enter the number ’5’ into the system.

vii. 6 - Shall enter the number ’6’ into the system.

viii. ERF OFST - Shall transmit ERF data to net members when RT is operating in FH-M mode. Also shall load/check SC offset frequencies.

ix. CHG 7 - Shall change current information on display to another available selection. Shall also enter the number ’7’ into the system.

x. 8 - Shall enter the number ’8’ into the system.

xi. LOUT 9 - Shall enter the number ’9’ into the system, and shall also retrieve frequency lockout sets from permanent memory if the RT is operating as a Frequency Hop Master.

xii. TIME - Shall be used to check RT FH sync time clock.

xiii. CLR - Shall clear data from display if error was made during entry. Shall also clear data from RT memory.

xiv. LOAD 0 - Shall load data into holding memory in RT and to retrieve data from permanent memory into holding memory. Shall also enter the number ’0’ into the system.

xv. STO - Shall transfer data from RT holding memory onto permanent memory.

xvi. BATT CALL - Shall be non-functional.

(j) COMSEC switch shall be responsible for controlling the communication security modes of the RT. It shall be a 5 - position rotary switch with pointer knob, with the following positions:

i. PT - This position shall place the RT into plain text mode. The operator shall be required to pull the knob in order to place the knob into this position.

ii. CT - This position shall place the RT into cipher text mode.

iii. TD - This position shall be non-functional.

iv. RV - This position shall prepare the RT to receive a remote fill of COMSEC variables from the NCS.

v. Z - This position shall clear COMSEC keys. The operator shall be required to pull the knob in order to place the knob into this position.

(k) VOL/WHSP control shall be a rotational knob used for audio volume control. This knob shall also provide a pull out position which shall be non-functional.

(l) HUB Connector - Dummy cover that shall not be removable.

(m) AUD/FILL connector shall be a dummy 3-D connector.

(n) AUD/DATA connector shall be a dummy 3-D connector. In vehicular installations, a dummy 3-D cable shall connect to the AUD/DATA and the DATA A or DATA B connector of the mounting adapter.

(10) SINCGARS Radios shall be mounted in a short/long range radio configuration. This mounting shall replicate the AN/VRC-89A configuration which contains the following:

a. Amplifier-Adapter, Vehicular (mounting adapter) AM-7239B/VRC.
b. Amplifier, Radio Frequency AM-7238A/VRC.
c. Receiver-Transmitter, Radio RT-1523A.
d. Receiver-Transmitter, Radio RT-1523A.
e. Loudspeaker Control Unit, LS-671/U.

The Configuration shall be replicated as follows:

(a) The mounting adapter shall have two (2) SINCGARS receiver-transmitters as described above. The mounting adapter shall have a simulated Radio Frequency Amplifier connected, and shall also have the following components:

i. CB1 (power) switch shall be a two position trippable toggle switch with an ON and OFF position.

ii. Indicator lamp and lens shall be a green dimmable indicator. The indicator shall flash for 3 +/- 1 second after CB1 switch is moved to ON position, then stay lit. The lens shall allow the indicator to be dimmed by turning clockwise.

iii. The (AUD/DATA B J2) connector shall be a 3-D dummy connector.

iv. The (AUD/DATA A J3) connector shall be a 3-D dummy connector.

v. The (DATA B J4) connector shall be a 3-D dummy connector with a dummy cable connected to the AUD/DATA connector on the top radio.

vi. The (DATA A J5) connector shall be a 3-D dummy connector with a dummy cable connected to the AUD/DATA connector on the bottom radio.

vii. The (SPKR J6) connector shall be a 3-D dummy connector.

(b) The Radio Frequency Amplifier shall be connected to the mounting adapter. The Radio Frequency Amplifier shall have the following components.

i. The (J1) connector shall be a dummy connector. A dummy cable which represents the connection to a vehicle antenna shall be connected to the J1 connector.

ii. The (J2) connector shall be a dummy connector. A dummy cable which also connects to the ANT connector of the RT mounted in the bottom position of the mounting adapter shall be connected to the J2 connector.

(11) MAIN GUN LOAD/UNLOAD switch shall be a trainer unique switch, When depressed, this switch shall initiate the virtual task of loading the main gun when unloaded and unloading the main gun when loaded.

(12) BREECH OPEN/CLOSE switch shall be a trainer unique, three position, spring-loaded to center switch. Activating the switch to the upper position shall initiate the virtual task of opening the main gun breech and activating the switch to the lower position shall initiate the virtual task of closing the breech.

(13) MAIN GUN STATUS - shall be a trainer unique panel that is used to monitor the status of the 120mm main gun. The panel shall contain the following:

(a) ROUND LOADED shall indicate that a virtual round is loaded in the breech.

(b) ROUND UNLOADED shall indicate that a virtual round is not loaded.

(c) BREECH CLOSED shall indicate that the breech is closed.

(d) BREECH ACCESSIBLE shall indicate that the breech is in a position to be opened.

(e) BREECH OPENED shall indicate that the breech is opened.

(f) STUB DEFLECTOR UP shall indicate that the stub deflector is in the up position.

(g) STUB DEFLECTOR DOWN shall indicate that the stub deflector is in the down position.

(14) The coax machine gun ammo supply, load and unload functions as follows:

(a) CANS IN STORAGE - shall be a trainer unique panel used to monitor the storage and control the removal of cans of ammo from the 7.62mm storage area. The following components shall be provided:

i. CANS IN STORAGE shall be a 2 digit display that indicates the simulated number of ammo cans in the ammo storage area.

ii. TRANSFER A CAN TO READY shall be a pushbutton switch that indicates the simulated transfer of an ammo can from the storage area to the 7.62mm coaxial machine gun feed chute.

(b) ROUNDS IN READY BOX - shall be a trainer unique panel indicating the number of rounds in the ready box.

(c) MACHINE GUN - shall be a trainer unique panel used to control and monitor the loading and unloading of the 7.62mm coaxial machine gun. The following components shall be provided:

i. LOAD/UNLOAD shall be a pushbutton switch that when depressed initiates the simulated loading of the 7.62mm coaxial machine gun if unloaded or the simulated unloading of the 7.62mm coaxial machine machine gun if loaded.

ii. LOADED indicator shall be a red indicator that illuminates when the 7.62mm coaxial machine gun is loaded. The indicator shall flash during the simulated load time.

iii. UNLOADED indicator shall be a green indicator that illuminates when the 7.62mm coaxial machine gun is unloaded. The indicator shall flash during the simulated unload time.

(15) Coax ammunition ready box shall be a mock-up.

(16) Coax ammunition feed chute shall not be replicated.

(17) Azimuth travel lock shall not be replicated.

(18) Loader's seat assembly shall replicate the actual M1A1 loader's seat and shall include the full range of motion and adjustments except that the seat back shall not fold down. The seat shall include the following:

(a) Height adjustment lever
(b) Swing latch
(c) Seat back
(d) The seat shall have the capability of simulating vehicle vibrations via an embedded speaker or transducer as specified in H.30.1.1.7.6.

(19) Ready rack ammo status shall be eighteen trainer unique indicators. These indicators shall indicate the number of virtual rounds being stored. If rounds are being stored, these indicators shall indicate what type, "SABOT" or "HEAT".

(20) SEMI-READY AMMUNITION RACK - shall be a trainer unique panel used to monitor the storage and control the removal of rounds from the semi-ready rack. The following components shall be provided:

(a) AMMO DOOR OPEN/CLOSE switch shall be a pushbutton switch that when depressed initiates the simulated opening of the semi-ready rack door if closed or the simulated closing of the semi-ready rack door if open.

(b) AMMO DOOR OPEN indicator shall be a red indicator that illuminates when the semi-ready rack is open. The indicator shall flash during the simulated opening time.

(c) AMMO DOOR CLOSED indicator shall be a green indicator that illuminates when the semi-ready rack is closed. The indicator shall flash during the simulated closing time.

(d) HEAT indicator shall be a two digit display that indicates the number of virtual HEAT rounds stored in the semi-ready rack. The display shall be blank when the AMMO DOOR CLOSED indicator is illuminated.

(e) REMOVE FROM RACK switch shall be a pushbutton switch that initiates the removal of a virtual HEAT round from the semi-ready rack. The switch shall be inoperative when the AMMO DOOR CLOSED indicator is illuminated.

(f) APFSDS indicator shall be a two digit display that indicates the number of virtual SABOT rounds stored in the semi-ready rack. The display shall be blank when the AMMO DOOR CLOSED indicator is illuminated.

(g) REMOVE FROM RACK switch shall be a pushbutton switch that initiates the removal of a virtual SABOT round from the semi-ready rack. The switch shall be inoperative when the AMMO DOOR CLOSED indicator is illuminated.

(21) HULL AMMUNITION RACK - shall be a trainer unique panel used to monitor the storage and control the removal of rounds from the hull ready rack. The time delays associated with the manual operation of the ammunition door, door clamps, and clamp bar shall be simulated in the design of the ammunition transfer. The panel shall be active only when the turret is positioned between 300 and 310 degrees (0 degrees is when the main gun is pointing forward and aligned with vehicle centerline). The following components shall be provided:

(a) AMMO DOOR OPEN/CLOSE switch shall be a pushbutton switch that when depressed initiates the simulated opening of the hull ammo door if closed or the simulated closing of the hull ammo door if open.

(b) AMMO DOOR OPEN indicator shall be a red indicator that illuminates when the hull ammo door is open. The indicator shall flash during the simulated opening time.

(c) AMMO DOOR CLOSED indicator shall be a green indicator that illuminates when the hull ammo door is closed. The indicator shall flash during the simulated closing time.

(d) HEAT indicator shall be a two digit display that indicates the number of virtual HEAT rounds stored in the hull ammo rack. The display shall be blank when the AMMO DOOR CLOSED indicator is illuminated.

(e) REMOVE FROM RACK switch shall be a pushbutton switch that initiates the removal of a virtual HEAT round from the hull ammo rack. The switch shall be inoperative when the AMMO DOOR CLOSED indicator is illuminated.

(f) APFSDS indicator shall be a two digit display that indicates the number of virtual SABOT rounds stored in the hull ammo rack. The display shall be blank when the AMMO DOOR CLOSED indicator is illuminated.

(g) REMOVE FROM RACK switch shall be a pushbutton switch that initiates the removal of a virtual SABOT round from the hull ammo rack. The switch shall be inoperative when the AMMO DOOR CLOSED indicator is illuminated.

(22) Loader’s NBC hookups are as follows:

(a) Mask air duct socket shall be physically and functionally replicated.

(b) Cooling Vest air duct socket shall be physically replicated.

(c) Cooling Vest air duct socket cap shall be physically and functionally replicated.

(23) Loader's Condition indicator - shall be a trainer unique 2 lamp assembly. An amber lamp shall be illuminated when the loader is considered to be wounded; a red lamp shall be illuminated when the loader is considered dead.

(24) Shoulder guard shall be physically and functionally replicated.

(25) Knee guard shall be physically and functionally replicated.

(26) Deleted

(27) Safety guard shall be physically and functionally replicated. The following related items will be replicated as follows:

(a) Frame shall be physically and functionally replicated.

(b) Latch bolt shall be physically and functionally replicated.

(28) Foot guard shall be physically and functionally replicated.

30.1.2.2.4 120 mm Main Gun.

The following controls, indicators, and other pieces of equipment shall be provided in the locations as found in the actual M1A1.

a. The following controls, indicators, and other pieces of equipment shall be simulated as follows:

(1) Breechblock shall be a mock-up.

(2) SAFE/ARMED switch handle shall be a two position handle assembly for arming and disarming main gun firing circuit.

(3) Coaxial machine gun mount shall be a mock-up.

(4) Replenisher shall not be replicated.

(5) Elevation travel lock shall not be replicated.

(6) Deleted

(7) Ejection chute shall be a mock-up.

(8) Zero degree elevation switch shall not be replicated.

(9) Deleted

(10) Machine gun firing solenoid shall be a mock-up.

(11) 7.62 mm coaxial machine gun shall be a partial mockup. The forward portion of the 7.62 mm coaxial machine gun shall not be replicated due to the fact that it falls outside of the boundaries of the M1A1 module.

(12) Smoke box shall not be replicated.

(13) Electronics Rack shields and guards shall be mock-ups. The following items (which fall behind these shields) shall not be represented:

(a) Computer Electronics Unit (CEU)

(b) Gun/Turret Drive Electronics (GTD)

(c) Line-of-Sight Electronics (LOS)

(d) Thermal Imaging Control Unit (TEU)

(e) Thermal Imaging Control Power Control Unit (PCU)

(14) Hull/Turret Slipring guards shall be mock-ups. The Hull/Turret slipring which falls behind the shields) shall not be represented.

30.1.2.2.5 Trainer Unique - Common.

The following controls, indicators, and other pieces of equipment shall be trainer unique equipment common to all M1A1 simulation systems.

a. The following controls, indicators, and other pieces of equipment shall be simulated as follows:

(1) Simulated compass (grid azimuth indicator) shall be a three digit display depicting the orientation of the long axis of the vehicle on the simulated terrain referenced to grid north. The simulated compass shall be available inside the compartment only after the vehicle has been stationary for 15 seconds.

(2) Turret/hull reference indicator shall be a series of indicators displaying the direction/orientation of the turret relative to the hull, +/- 15 degrees.

30.1.2.2.6 Commander's Popped Hatch Unique Components.

The following controls, indicators, and other pieces of equipment shall be provided in the locations as found in the actual M1A1, except as stated otherwise.

a. The following controls, indicators, and other pieces of equipment shall be simulated (functional):

(1) Binocular capability shall be provided by a trainer unique device as follows:

(a) A momentary pushbutton switch shall be provided which, when depressed, will enable the binocular capability on the CPH display.

(b) A two axis joystick shall be provided which, when the momentary pushbutton is depressed, shall slew the binocular reticle in azimuth and the CPH imagery in elevation.

(2) Night vision goggles shall be functionally replicated as follows:

(a) A trainer unique momentary pushbutton switch shall be provided which will enable and disable the night vision capability.

(b) When the night vision capability is activated, the CPH shall display night vision imagery.

(c) Not used.

30.1.2.3 External Interface Unit.

The M1A1 manned module shall be provided with an External Interface Unit (EIU) that consists of an entry device and display device. The EIU shall be used to display the following information:

a. Exercise number,

b. Vehicle identification number.

The EIU shall be used to control and monitor the following M1A1 functions:

a. Initiation and termination of self-repairs,

b. Initiation and termination of fuel transfers,

c. Initiation and termination of ammo transfers,

d. deleted

e. Connection and disconnection of a tow kit to another vehicle,

f. External munitions loading,

g. Damage assessment.

h. Load SINCGARS hop set and COMSEC data.

APPENDIX I
M2A2/M3A2 MANNED MODULE

10. Scope.

This appendix establishes requirements for the M2A2/M3A2 manned module.

20. Applicable Documents.

(This section is not applicable to this appendix.)

30. Requirements.

30.1 M2A2/M3A2 Simulator Module.

The M2A2/M3A2 simulator shall be designed to replicate the performance characteristics of the M2A2/M3A2 vehicle and associated systems as described in I.30.1.1 through I.30.1.2.2. These characteristics shall enable the M2A2/M3A2 simulators to operate in the CCTT environment and shall provide the manned crew the system performance specified herein. The M2A2/M3A2 module shall be either an M2A2 or M3A2 vehicle as determined during initialization by the MCC. The difference between the M2A2 and the M3A2 shall be the mounted infantry, missile and ammunition allocations.

30.1.1 Performance Characteristics.

The following paragraphs contain the minimum detailed performance requirements that shall be provided for the M2A2/M3A2 BFV simulator system. The M2A2/M3A2 manned module shall also meet the generic design requirements of section 3.6.

30.1.1.1 Deleted.

30.1.1.2 Fire Control System.

The fire control system for the M2A2/M3A2 simulation system shall replicate the ability for target acquisition, tracking, aiming and firing of the M242 25 mm Automatic Gun, the Tube-launched, Optically-tracked, Wire-guided (TOW) weapon system, the M240C 7.62 mm Coaxial Machine Gun, and the M257 Smoke Grenade Launcher. The simulated fire control system components shall replicate the operational equipment in both design and performance. The simulated fire control system shall accurately incorporate sighting reticles and fire control models and shall enable precision gunnery techniques in simulated battlefield environments. The fire control system shall consist of:

a. Gunner’s Integrated Sight Unit (ISU) and controls,

b. Backup Sight,

c. Commander’s ISU relay,

d. Weapon control box,

e. TOW control box.

These components in combination with the other simulated systems in the M2A2/M3A2 simulation system shall provide the crew the ability to engage targets from both stationary and on the move positions with a precision that matches real world results.

30.1.1.3 M2A2/M3A2 Weapons and Ammunition.

30.1.1.3.1 M2A2/M3A2 Ammunition

The M2A2/M3A2 simulation system shall simulate the following weapons and ammunitions:

a. M242 25 mm Automatic Gun, using the following ammo:

(1) M792, High-Explosive Incendiary with Tracer (HEI-T),

(2) M919, Armor-Piercing Fin-Stabilized Discarding SABOT with Tracer (APFSDS-T),

b. M240C 7.62 mm coaxial machine gun, using the A141, Ball, Tracer, ammo

c. TOW 2 missile system, using the TOW 2 BGM71D with maximum range of 3750 meters,

d. M257 Smoke Grenade Launcher system, using the L8A3 RP smoke grenades.

30.1.1.3.2 M2A2/M3A2 DI Stowed Ammunition

The M2A2/M3A2 simulation system shall stow the following ammunition for DI battlefield resupply:

a. Javelin and/or Dragon Anti-Tank Missiles,

b. AT-4 (84mm, M136),

c. 5.56mm Ball & linked Tracer (A064),

d. 5.56mm Ball (M855), Tracer (M856),

e. 7.62mm, A141 Ball, Tracer,

f. 40mm Grenades (M433 single grenades),

g. Claymore Anti-personnel mines (M18), Anti-personnel mines (M16A1) and Anti-Tank mines (M21).

30.1.1.4 Support Systems.

30.1.1.4.1 Electrical System.

The electrical system shall be able to assume the following operating states:

a. Engine off, master power off, turret power off.

b. Engine off, master power on, turret power off.

c. Engine running, alternator working, turret power off.

d. Engine running, alternator not working, turret power off.

e. Engine off, master power on, turret power on, turret drive on, stabilizer on.

f. Engine off, master power on, turret power on, turret drive on, stabilizer off.

g. Engine running, alternator working, turret power on, turret drive on, stabilizer on.

h. Engine running, alternator working, turret power on, turret drive on, stabilizer off.

Based on which operating state the electrical system is in, the associated problems and abilities shall be reflected in the M2A2/M3A2 simulation system. These problems and abilities shall be replicated in the M2A2/M3A2 simulation systems just as they would occur in the operational equipment.

30.1.1.4.2 Hydraulic System.

The ramp hydraulic pump shall be virtual (no physical pump). The effect of the ramp hydraulic pump on raising and lowering the virtual BFV ramp shall be simulated.

30.1.1.5 Depletable Resource Management.

Depletable resource management shall cover the management, consumption, and resupply of both fuel and ammunition. The fuel for the M2A2/M3A2 BFV simulation system shall be based on the usable fuel (175 gal.) contained in the fuel tanks. The resupply of fuel shall be accomplished through coordination with the ALOC and shall occur with the use of a fuel carrier. The ammunition load for the M2A2/M3A2 simulation system shall be based on the storage capacities of the actual M2A2/M3A2 BFV for the weapons and ammunition identified in paragraph I.30.1.1.3. The identification, transfer and resupply of ammunition shall be the responsibility of the vehicle commander. The resupply of all ammunition shall be coordinated through the ALOC. In all cases, the monitoring of, use of and resupplying of the M2A2/M3A2 BFV's fuel and ammunition shall be based on the implementation of representative time and depletion parameters obtained from the operational BFV. The Resupply Operations shall include:

a. Simulated Transfer of:

(1) Fuel from a fuel carrier to the M2A2/M3A2 BFV

(2) Fuel from fuel pre-stock to the M2A2/M3A2 BFV

(3) Ammunition from ready rack of the TOW to the launcher

(4) Ammunition from an ammunition truck

(5) Ammunition from 25 mm storage to the ready box (ammo can)

(6) 7.62 ammunition from storage to ready

(7) Reload times for the weapons listed in paragraph I.30.1.1.3

(8) Ammunition from another module with compatible ammunition.

b. Depletion rates:

(1) Fuel quantity and usage related to BFV consumption rate.

The depletion rate shall be based on actual expenditure rates.

30.1.1.6 Damage and Failure.

The list of components that are modeled for combat damage, stochastic failure, and deterministic failure shall be as defined in Table I-I.

Table I-I. M2A2/M3A2 Failures and Damage

Component/System	Deterministic	Stochastic	Combat Damage
Air Filter		X	
Antenna A and B			X
Cmdr's Power Control Handle		X	
Coax Gun Boresight		X	
Coax Gun Inoperative		X	X
Commander			X
Driver			X
Drown	X		
Engine Assembly		X	X
Engine Loss of Power		X	
Engine Starter		X	X
Fuel Filter		X	
Gun Elevation Drive	X	X	
Gunner			X
Gunner's Auxiliary Sight			X
Gunner's Power Control Handles		X	

Table I-I. M2A2/M3A2 Failures and Damage

Component/System	Deterministic	Stochastic	Combat Damage
Intercom		X	X
ISU Day		X	X
ISU Thermal		X	X
Left Idler Wheel		X	X
Left Roadwheel 1		X	X
Left Roadwheel 2		X	X
Left Roadwheel 3		X	X
Left Roadwheel 4		X	X
Left Roadwheel 5		X	X
Left Roadwheel 6		X	X
Left Sprocket		X	X
Left Track	X	X	X
Main Gun Ammunition			X
Main Gun Boresight		X	
Main Gun Inoperative		X	
Main Gun Misfire		X	
PLGR	X		
Radio A		X	X
Radio B		X	X
Right Idler Wheel		X	X
Right Roadwheel 1		X	X
Right Roadwheel 2		X	X
Right Roadwheel 3		X	X
Right Roadwheel 4		X	X
Right Roadwheel 5		X	X
Right Roadwheel 6		X	X
Right Sprocket		X	X
Right Track	X	X	X
Rollover	X		
Service Brake		X	
TOW Elevation Drive		X	

Table I-I. M2A2/M3A2 Failures and Damage			
Component/System	**Deterministic**	**Stochastic**	**Combat Damage**
TOW Launcher Misfire		X	
Transmission Assembly		X	X
Turret Azimuth Drive	X	X	
Turret Stabilization		X	

30.1.1.7 Sound Generation System.

A sound and acoustic vibration generation system shall be provided. The sound system shall be completely separate from the communication system, and the sounds and vibrations shall be presented independently from any headphone system (i.e. multiple loudspeakers). The sounds and vibrations shall be of such fidelity, quality, realism, and volume that crew members shall experience the cues, stresses, and distractions of a “real life” combat situation. The sounds shall be of sufficient volume so that the distractions provided to the crew members shall equal that found in an actual situation, but in no case shall 95 dB be exceeded for steady state noise (measured external to the CVC helmet). Table G-II lists the sound cues that shall be provided in the M1A1 simulation system.

Table I-II. M2A2/M3A2 Sound Cues
SOUND CUE
Engine cranking
Engine start to idle
Engine stop
Engine noise related to Revolutions Per Minute (RPM)
Transmission noise related to RPM
Release hand brake
Set hand brake
Track noise related to speed for terrain types simulated in CCTT
Track popping (about to be thrown)
Turret traverse noise related to turret RPM - slow mode
Turret traverse noise related to turret RPM - fast mode
Palm switch depress (turret drive engage)
Palm switch release (turret drive release)
Lower ramp - begin
Lower ramp - continuous
Lower ramp - end
Raise ramp - begin
Raise ramp - continuous

Table I-II. M2A2/M3A2 Sound Cues
SOUND CUE
Raise ramp - end
Cargo hatch opening and closing
25 mm gun elevate and depress
25 mm gun hitting upper and lower limits
Gun exhaust fan
TOW launcher up
TOW launcher down
Horn
Collisions with objects (scraping and hard collisions)
Fire TOW
Fire 25 mm gun
Fire 7.62 mm coaxial machine gun
Fire smoke grenade launcher
NBC System main blower
Driver’s Warning Tone
Bilge Pumps
Friendly and hostile main gun fire
Friendly and hostile missile launch
Friendly and hostile rocket launch
Generic explosive round (main gun, missile, rocket) hit
Generic explosive round (main gun, missile, rocket) miss
Generic kinetic round hit
Friendly and hostile machine gun fire - large caliber
Friendly and hostile machine gun fire - small caliber
Friendly and hostile mine hit
Friendly and hostile bomb hit
Friendly and hostile bomb miss
Friendly and hostile artillery hit
Friendly and hostile artillery miss
Wheeled vehicle - large class
Wheeled vehicle - small class
Aircraft - rotary wing class

Table I-II. M2A2/M3A2 Sound Cues
SOUND CUE
Aircraft- fixed wing class

30.1.1.7.1 Sound Synchronization.

The sound system shall be synchronized with the visual displays and the M2A2/M3A2 controls within the system latency requirements as defined in paragraph 3.2.2.1 and within the module latency requirement as defined in paragraph 3.2.2.2.

30.1.1.7.2 Sound Generator.

During real-time operation, the desired sounds shall be stored in the sound system and shall be instantly available in real-time to the vehicle simulator. The system shall provide outputs for driving speakers and subwoofers. The sound generation system shall have the ability of generating a minimum of eight sounds simultaneously with full parametric control of frequency and volume. Where appropriate, sound generation channels shall be “shared” by several different sounds on a priority basis. The number of sound generation channels shall be expandable to allow for future needs that may require the ability to generate a larger number of sounds simultaneously.

30.1.1.7.3 Sound Storage.

The M2A2/M3A2 simulation system shall have the capacity to store all sound data and shall be expandable to allow for future increases in storage that would be necessary to generate a larger base of sound data.

30.1.1.7.4 Spatial Positioning.

The sound system shall provide spatial positioning of the sound cues. The sounds shall be synchronized with the actions causing the sounds and shall be presented to allow personnel the ability to identify the distance (amplitude and time delay) of the events causing the sounds. For the Popped Hatch speakers, the sounds shall be synchronized with the actions causing the sounds and shall be presented to allow personnel the ability to identify the direction of the events causing the sounds.

30.1.1.7.5 Audio Amplifiers.

The audio amplifiers shall be of sufficient quality and power-handling ability to recreate the required volume levels without distortion greater than 0.05 percent Total Harmonic Distortion (THD) over the dynamic range.

30.1.1.7.6 Speakers.

Audio cues shall be presented via speakers contained in each of the manned module crew compartments. The speaker configuration for the M2A2/M3A2 manned modules shall be as defined in Table I-III. Headphones shall not be required to present the ambient “sounds of battle.” Vibration cues (e.g. vehicle vibrations, weapons fire, and vibrations from explosions) shall be presented to the crew members through the use of subwoofers. Speaker placement within the module shall support spatial positioning in the Popped Hatch speakers only.

Table I-III. M2A2/M3A2 Module Speaker Arrangement				
MODULE TYPE		**SPEAKER**	**SEAT SPEAKER**	**SUBWOOFER**
M2A2/M3A2	Driver compartment	4	1	1
	Crew compartment	8	2	1
M2A2/M3A2 CPH	Driver compartment	4	1	1
	Crew compartment	8	2	1
	Popped hatch	4	0	0

30.1.1.7.7 Sound Quality.

The sound generator shall provide a frequency range of 25 Hertz (Hz) +/- 5 Hz to a minimum of 12,000 Hz. The audio amplifiers shall provide a frequency range of 25 Hz +/- 5 Hz to a minimum of 20,000 Hz. The combined signal to noise ratio of the sound generator and audio amplifiers shall be a minimum of 70 dB. The combination of speaker types shall provide a composite frequency response of 25 Hz to 20,000 Hz +/- 10 dB (after each speaker has been independently referenced to 0 dB).

30.1.1.8 Communication System.

A communication system shall be provided for the M2A2/M3A2 manned module as described in section 3.7.6 of this specification.

30.1.1.9 Visual Display System.

The visual display system shall meet the requirements stated in Appendix A, Visual System For The Close Combat Tactical Trainer. The M2A2/M3A2 BFV shall be able to mount and dismount an infantry unit in the visual database.

30.1.2 Physical Characteristics.

Paragraphs I.30.1.2.1 through I.30.1.2.2 describe the physical characteristics of the individual crew stations and other components of the M2A2/M3A2 simulator module that shall be provided. The M2A2/M3A2 crew compartment shall exist as two separate enclosures: (1) an enclosure for the driver’s station and (2) an enclosure for the commander and gunner stations, and the troop compartment. The base for each enclosure shall provide support for all module components and shall incorporate forklift provisions to facilitate handling and transportation. The driver, commander, and gunner positions shall each include a seat replicating the respective seats found in the operational M2A2/M3A2 BFV. The troop compartment shall provide seating for three troops and shall provide the ability for the individuals in the troop compartment to monitor all communications within the vehicle simulator. The modules shall provide the controls, switches, indicators and space constraints required to meet the training tasks while avoiding negative training. Some of these items shall be fully replicated while the others shall be mock-ups to provide the tactile sensations and space constraints of the actual vehicle. Functional controls, indicators and other pieces of equipment shall have proper coloring and labels.

30.1.2.1 Controls and Indicators.

The following paragraphs list the controls and indicators that shall be provided for the individual crew stations within each M2A2/M3A2 simulator system. These controls and indicators shall replicate in design, performance, and function their real world counter-parts that are found in the operational M2A2/M3A2 Bradley Fighting Vehicle (BFV). Realistic control loading and physical limits of travel shall be provided for simulated crew member controls, such as pedals, handles, and T-bars.

30.1.2.1.1 Driver’s Station.

The following controls, switches, gauges, and lights shall be provided at the Driver’s station in the locations and panels as found in the actual M2A2/M3A2 BFV.

a. The following controls, indicators, and other pieces of equipment shall be simulated (functional).

(1) Smoke Screen Generator switch - shall be a 2-position pull-to-toggle switch which shall have positions labelled ON and OFF. This switch shall replicate the appearance and movement of the corresponding actual control. This control shall be physically replicated but non-functional.

(2) Lights switch.

(a) LIGHTS UNLOCK switch - shall be a 2-position spring loaded lever which shall be labeled UNLOCK above. The switch shall return to the locked position when released. When held in the UNLOCK position, this lever will allow Driving Lights switch to be moved from BO MARKER to BO DRIVE, from OFF to STOP LIGHTS, and from STOP LIGHTS to SERVICE DRIVE.

(b) Panel Lights switch - shall be a 4-position rotary switch which shall have positions labeled PANEL BRIGHT, DIM, OFF, and PARK. This switch shall replicate the functionality of the corresponding actual switch (which controls the panel lights) as follows :

i. The PANEL BRIGHT position shall turn panel lights on at highest level;

ii. The OFF position shall turn panel lights off;

iii. The DIM position shall be turn panel lights on at the lowest (dim) level.

iv. The PARK position shall turn the tail lights off and on.

Master power must be on for BRIGHT and DIM positions to produce an observable effect, in other words, for the lights to be illuminated on the panel.

(3) Driving Lights switch - shall be a 5-position rotary switch which shall have positions labelled BO DRIVE, BO MARKER, OFF, STOP LIGHT, and SER DRIVE and shall be locked in the BO MARKER position unless the unlock switch

is in the UNLOCK position. This switch shall replicate the functionality of the corresponding actual switch (which controls vehicle exterior lights) in the following manner:

(a) The BO DRIVE position shall turn on the blackout driving lights, the outside front white blackout markers, and the outside rear red blackout markers;

(b) The BO MARKER position shall turn on all blackout markers and activate white blackout stop lights;

(c) The OFF position of the switch shall turn off all exterior lights;

(d) The STOP LIGHT position shall enable stoplights when brakes are applied;

(e) The SER DRIVE position shall turn on headlights and enable use of conventional stoplights.

(4) Fuel gauge - This indicator shall be a gauge with a range of 0 to 150 gallons. The amount of fuel remaining in the lower fuel cell shall be indicated on this gauge such that the needle shall be positioned in the green zone for levels above 30 +/- 5 gallons and in red zone for lower levels. The needle shall be positioned at the far right of the green zone for fluid levels of 150 gallons and greater (the fuel sending unit is in the lower, 150 gallon, tank).

(5) Turret Power indicator - shall be a red lamp which shall be illuminated when turret power is on.

(6) Launcher Up indicator - shall be a red lamp which shall be flashed at a 1.6 Hz +/- 10% rate when the tow launcher is in the firing position and the vehicle is moving at a speed of 3 mph and faster.

(7) Air Cleaner Clogged indicator - shall be a red lamp which shall be flashed at 1.6 Hz +/- 5% when engine is running and the air cleaner is clogged.

(8) Speedometer with Odometer - The speedometer shall replicate the speedometer on the BFV both physically and functionally. The rotational speed of the transmission shall drive this gauge to indicate vehicle speed. The gauge shall have scale markings for both miles per hour and kilometer per hour with ranges of 0-60 and 1-100 respectively and a full-scale accuracy of +/- 10%. The odometer shall consist of a display which shall indicate the the distance the vehicle has traveled in kilometers.

(9) Volts gauge - This indicator shall be a gauge with a range of 16.5 to 32.0 +/- 0.5 volts and shall indicate battery and generator conditions as follows:

(a) The needle shall be positioned in the Left Red Zone when the battery is between 17.5 +/- 1.5 and 23.5 +/- 1.0 volts.

(b) The needle shall be positioned in the Yellow Zone when battery voltage is between 23.5 +/- 1.0 and 27.5 +/- 1.0 volts.

(c) The needle shall be positioned in the Green Zone when the battery voltage is between 27.5 +/- 1.0 volts and 30.5 +/- 0.5 volts.

(d) The needle shall be positioned in the Right Red Zone when the battery voltage is between 30.5 +/- 0.5 and 32.0 +/- 0.5 volts.

(10) Trans Oil Press indicator - shall be a red lamp indicator which shall illuminate when the transmission is damaged or a lamp test is executed.

(11) Trans Oil Temp indicator - shall be a red lamp indicator which shall illuminate when the transmission is damaged or a lamp test is executed.

(12) Fuel Filter Clogged indicator - shall be a red lamp indicator which shall be flashed at 1.6 Hz +/- 10% when the engine is running and the fuel filter is clogged.

(13) Engine Coolant Temperature gauge - shall be a gauge with a range of 100 to 280 degrees +/- 5%, which shall indicate engine coolant temperature range as follows:

(a) The needle shall be positioned in the red zone when the engine coolant temperature is greater than 220 and less than or equal to 280 degrees F.

(b) The needle shall be positioned in the yellow zone when the engine coolant temperature is greater than 190, and less than or equal to 220 degrees F.

(c) The needle shall be positioned in the green zone when the engine coolant temperature is less than or equal to 190 degrees F.

(14) Gear Selector Panel.

(a) Gear Selector lever - shall be an 8-position lever which shall have positions labeled REVERSE, N, START, PIVOT STEER, DRIVE, LOW, TOW START, and TOW, and shall have a spring-loaded gate which prevents accidental movement into the TOW START position. The functionality of the corresponding actual lever shall be replicated as follows:

i. The REVERSE position shall put the transmission in reverse;

ii. The N (neutral) position shall disengage the transmission;

iii. The START position shall engage the engine starting system;

iv. The PIVOT STEER position shall enable pivoting the vehicle about its center with vehicle stopped;

v. The DRIVE position shall put the transmission in the normal forward operating range;

vi. LOW shall put the transmission in low range if the vehicle speed is less than 8 mph, and shall have no effect when selected at speeds of 8 mph and faster.

vii. TOW START shall be non-functional.

viii. deleted

Transmission selections shall modify the action of the engine output. The transmission control shall only be functional when the engine is running.

(b) Tow Start Lockout - shall be a spring-loaded gate which shall prevent the gear selector from being moved to the TOW START position when engaged.

(15) Parking brake handle shall be a 2 position handle assembly interlocked with the gear selector to restrict movement of gear handle when parking brake is engaged. Parking brake shall be engaged when handle is pulled out. The force required to pull the handle out shall increase from 4 pounds +/- 10% to 25 pounds +/- 10% as the handle is pulled. The force required to release the handle shall be 4 pounds +/- 1 pound. The travel distance of the handle shall be 0.9 inches +/- 10%.

(16) Driver’s Night Vision Viewer (NVV) shall be simulated version of the AN/VVS-2 NVV and shall interface to the visual system. Installing the simulated NVV shall cause the visual system to display a graphical night vision replication of the surrounding terrain which shall be presented whenever simulated power is available to the viewer. The driver shall be able to install and remove the driver’s night viewer.

(a) Off-Bright Rotary switch - shall be a potentiometer that shall simulate the removal of power from the NVV when in the OFF position (rotated fully counter-clockwise), and shall increase the level of brightness of Driver’s Night Vision Viewer when potentiometer is rotated clockwise.

(b) Electrical Hookup - shall be a connector which allows connection of the Driver’s Night Vision Viewer to vehicle master power. The status of this connection shall be used to determine whether display of night vision or normal vision terrain is to be simulated.

(c) NVV stowage bracket and strap - shall allow for stowage of the simulated NVV.

(d) NVV Rotate - shall be a trainer unique active control that shall simulate slewing the NVV imagery +/- 45 degrees in azimuth.

(17) Steering yoke and pedals.

(a) Driver's Intercom switch - shall be a pushbutton on the steering handle, which, when depressed, shall function as push-to-talk switch to allow the driver to speak over the intercom while steering.

(b) Brake pedal - shall be a potentiometer assembly, which, when operated, shall slow and stop the simulated motion of the vehicle. The force required for pedal movement shall be 16 pounds. The travel distance of the pedal shall be 6 inches +/- 10%. The simulated braking distances and deceleration rates provided by brake pedal depression shall be within 15% of the actual forces in the M2A2/M3A2 BFV.

(c) Accelerator pedal - shall be a potentiometer assembly, which, when operated, shall increase the simulated speed of the engine. The force required for pedal movement shall be 12 pounds +/- 3 pounds breakaway and 30 pounds +/- 5 pounds ending. The travel distance of the pedal shall be 3 inches +/- 10%.

(d) Steering Yoke assembly shall be a potentiometer assembly which shall replicate the functionality of the corresponding actual control in providing steering inputs to the vehicle. Rotation of the yoke to the left shall cause the vehicle to turn left; right rotation shall turn the vehicle to the right. Steering control deadband shall be 10 degrees +/- 5 degrees. Range of travel of the yoke assembly shall be from 48 degrees +/- 5 degrees in either direction. Breakaway force of the steering mechanism shall be 6 pounds (+/- 2 pounds) applied 5.5 inches from the centerline of the Steering Yoke assembly. Ending force shall be 27 pounds (+/- 10%) applied 5.5 inches from the pivot axis of the assembly. Specified breakaway and ending forces shall apply to rotation in either direction.

(e) Brake pedal adjuster - shall be a mechanical component, which shall replicate the functionality of the corresponding control in the actual vehicle by adjusting the height of the brake pedal.

(f) Beam Selector button - shall be a pushbutton on the floor, which toggles from high to low beam headlights when depressed.

(18) Fuel and Throttle Control panel.

(a) Fuel Control Handle - shall be a 2 position handle, which, when pulled, shall stop fuel flow to the engine and when pushed shall start fuel flow to engine.

The force required for handle movement shall be 18 pounds. The travel distance of the handle shall be 2.25 inches +/- 0.5 inches.

(b) Throttle control and Push to Release Button shall be a push-pull handle and pushbutton assembly. The throttle control, when pulled, shall increase engine speed and, when pushed, shall decrease engine speed. The throttle control shall have a deadband of 1.25 inches +/- 0.5 inches. Maximum deflection shall be 2 inches +/- 0.5 inches. The force required to move the handle shall be 3 pounds +/- 2 pounds. The force required to push the Push to Release button shall be 15 pounds +/- 2 pounds. The throttle control shall only be functional when the engine is running. The Push to Release button shall, when depressed, allow the Throttle Control to be pushed in to the handle's limit.

(19) Slope Indicator - shall be a simulated bubble assembly which indicates simulated vehicle angle from level to 10 degrees. Bubble shall be positioned in center of black circle when the vehicle is level, and shall move outward as slope increases. The bubble shall touch the blue circle at 5 degrees and the red circle at 10 degrees and greater.

(20) Driver's Vision Blocks - 4 vision blocks (periscopes) shall be provided to the driver which shall display scenes generated by the visual system as specified in Appendix A. The driver's center vision block (periscope) shall be removable to allow installation of the driver's NVV. The driver's periscope clamps and thumbs screws shall be replicated.

(21) Domelight.

(a) Light Selector switch - shall be a 3 position rotary switch with blackout and white light positions. In the off position this switch shall turn off both the blackout and white lights. The other two positions shall turn on the associated lights.

(b) Blackout Release button - shall be a pushbutton switch, which when depressed allows moving the Light Selector switch from blackout to white light position.

(c) White lamp - shall be illuminated whenever the Light Selector switch is in the white light position.

(d) Blackout lamp - shall be one discrete output which shall be illuminated when the Light Selector switch is in the blackout position and vehicle power is on.

(22) Ramp lever (locking lever)- shall be a 2-position lever with pushbutton. The Ramp lever shall lock the ramp in the raised position when up, and shall unlock the ramp for lowering when down (raising and lowering the ramp shall be controlled by the

Ramp switch), Depressing the pushbutton shall allow the Ramp lever to be moved into the down position.

(23) Vehicle Distribution Box.

(a) NBC switch shall be a 2 position pull-to-toggle switch which shall turn the NBC system on and off.

(b) NBC indicator shall be a green lamp which shall be illuminated when the NBC switch is in the ON position.

(24) Master Power indicator - shall be a green lamp which shall be illuminated when the Master Power switch is in the ON position.

(25) Engine Accessory indicator - shall be a green dome lamp which shall be illuminated when the Engine Accessory switch is in the ON position.

(26) Cold Start indicator - shall be a red lamp which shall be illuminated when the Cold Start switch is in the ON position.

(27) Fwd Bilge Pump indicator - shall be a green lamp which shall be illuminated when the Fwd Bilge Pump switch is in the ON position and master power is on.

(28) Rear Bilge Pump indicator - shall be a green lamp which shall be illuminated when the Rear Bilge Pump switch is in the ON position and master power is on.

(29) Smoke Screen indicator - shall be a yellow lamp which shall be illuminated when the Smoke Screen Generator switch is in the ON position and the master power is on.

(30) Engine Oil Low Press indicator - shall be a red lamp which shall be flashed at 1.6 Hz +/- 10% when engine oil pressure is below 5 psi.

(31) Left Turn indicator - shall be a green indicator which shall flash at 1.6 Hz +/- 10% when the Turn indicator switch is in the left turn position and also when in the hazard position.

(32) Right Turn indicator - shall be a green indicator which shall flash at 1.6 Hz +/- 10% when the Turn indicator switch is in the right turn position and also when in the hazard position.

(33) High Beam indicator - shall be an indicator which shall be illuminated when the headlight highbeams are on.

(34) Ramp Unlocked indicator - shall be a red lamp which shall be illuminated when the ramp is unlocked.

(35) Master Power switch - shall be a 2-position pull-to-toggle switch which shall have positions labelled ON and OFF and shall control vehicle master power. The switch set to the ON position shall illuminate the vehicle master power indicator and all gauge lights, and shall cause simulated vehicle master power to be on. Setting the Vehicle Master Power switch to the OFF position shall inhibit the functioning of all driver compartment switches and indicators and shall remove simulated master power.

(36) Starter Cutout Override switch - shall be a 2-position pull-to-toggle switch which shall have positions labelled ON and OFF. In the ON position, the starter automatic cutout is overridden to allow longer crank in cold conditions.

(37) Engine Accessory switch - shall be a 2-position pull-to-toggle switch which shall have positions labelled ON and OFF, and shall control engine accessory power. This switch shall activate a warning tone when moved to ON.

(38) Cold Start switch - shall be a 2-position toggle switch which shall have positions labelled ON and OFF. The switch shall replicate the operation of the cold start switch on the BFV.

(39) Fwd Bilge Pump switch - shall be a 2-position toggle switch which shall have positions labelled ON and OFF. This switch shall control power to 2 forward bilge pumps and shall cause the aural cue to be activated and the FWD Bilge Pump indicator to be illuminated.

(40) Rear Bilge Pump switch - shall be a 2-position toggle switch which shall have positions labelled ON and OFF. This switch shall control power to 2 rear bilge pumps and shall cause the aural cue to be activated and the REAR Bilge Pump indicator to be illuminated.

(41) Turn Indicator switch - shall be a 5-position lever switch. The center position shall turn the indicators off; the far left and right positions shall turn on the hazard lights; the middle left shall turn on the left turn indicator; the middle right shall turn on the right turn indicator.

(42) Horn button - shall be a 2-position pushbutton switch which shall activate the horn aural cue when depressed.

(43) Test Sensor switch - shall be a 2-position pushbutton switch. When depressed, the Coolant Low Level Indicator light shall flash at 1.6 Hz +/- 10%.

(44) Coolant Hi Temp indicator - shall be a red lamp which shall be flashed at 1.6 Hz +/- 10% when engine coolant temperature is greater than 225 +/- 5 degrees F.

(45) Coolant Low Level indicator - shall be a red lamp which shall be flashed at 1.6 Hz +/- 10% when the engine coolant level is less than the minimum required to activate the lamp.

(46) Driver's Condition indicator - shall be a trainer unique 2 lamp assembly. An amber lamp shall be illuminated when the driver is considered to be wounded; a red lamp shall be illuminated when the driver is considered dead.

(47) Driver's Head Tracker - is a trainer unique item which shall provide feed back indicating the orientation of the driver's head and shall be used for vision block control.

(48) Driver's Seat - shall be a functional replica of the vehicle seat with full range of motion and adjustment as in the actual M2A2/M3A2 BFV. The driver's seat assembly shall include a control knob, a control lever, a backrest release handle, and a mechanically operative seat belt (lap belt).

(49) Engine Oil Pressure gauge - shall replicate the engine oil pressure gauge in the BFV both physically and functionally. Gauge face shall be marked with 2 red and green bands, the lower band labeled IDLE, and the upper labeled NORMAL OPERATING. The position of the needle shall be a function of the calculated engine oil pressure, such that, with engine at idle, the needle shall be in the green zone of the lower band when oil pressure is between 10 and 150 PSI and in the red zone of the lower band when the oil pressure is less than 10 PSI, and with engine at normal operating speed, the needle shall be in the green zone of the upper band when the oil pressure is between 25 and 150 PSI and in the red zone of the upper band when the oil pressure is less than 25 PSI.

(50) Ramp switch - shall be a 3 position pull-to-toggle switch labeled UP above and DOWN below, and shall be momentary in both up and down positions. This switch shall raise the ramp while in the UP position, and shall lower the ramp while in the DOWN position.

(51) Driver's Intercom Control box.

(a) MONITOR switch shall be a 5 position rotary switch with positions labelled ALL, A, INT ONLY, B, and C (clockwise from left position). ALL position shall allow monitor of all channels, INT ONLY shall cause only the intercom to be monitored, and in A, B, C positions shall select the corresponding radio channel for monitoring.

(b) Volume knob - shall be a potentiometer with 270 degrees of rotation. Rotating the knob clockwise shall increase intercom volume; rotating the knob, counterclockwise shall decrease the intercom volume.

(c) Right connector (J802) shall allow for connection of an actual CVC helmet. The right connector shall also be used to detect the forward (radio) CVC helmet switch position and interface to the CVC helmet microphone and earphones (for both simulated intercom and radio).

(d) Left connector (J803) shall allow for connection of an actual CVC helmet. The left connector shall also be used to detect the rear (intercom) CVC helmet switch position.

(52) Deleted

(53) Fire Suppression switch - shall be a two-position pull-to-toggle switch which shall be labeled “MANUAL” in the up position and “AUTO” in the down position. In the up position, the switch shall select MANUAL mode of operation for the fire suppression system. In the down position, the switch shall select AUTO mode of operation.

(54) Driver’s NBC hookups are as follows:

(a) NBC system air intake hoses and spring clip shall be physically and functionally replicated.

(b) Driver’s NBC air hose shall be physically and functionally replicated.

(c) Driver’s NBC quick disconnect shall be physically and functionally replicated.

(55) Tone Cancel switch - shall be a 3-position toggle switch which shall have positions labeled TONE CANCEL and PUSH TO TEST. The TONE CANCEL position shall disable the Driver’s audio Warning Tone. The PUSH TO TEST position shall illuminate all Driver instrument panel indicators except for the Turret Power indicator.

(56) Driver’s Audio Warning Tone - shall be active and heard in the Driver’s CVC helmet.

(57) NVV Power Cable - shall be functionally replicated. The cable shall interface with the power receptacle on the simulated NVV.

(58) Hatch Cover Adapter - shall be physically replicated and shall interface with the NVV power cable for stowage.

b. The following controls, indicators, and other pieces of equipment shall be physically represented (operational but nonfunctional):

(59) Personnel Heater Control Box.

(a) Hi/Lo switch - shall be a dummy 2 position toggle switch labeled HI above and LO below.

(b) Run-Off-Start switch - shall be a dummy 3 position toggle switch labeled RUN at upper right, OFF at center right and START at lower right.

(c) Personnel Heater light - shall be a dummy amber indicator.

(60) Vehicle Distribution Box.

(a) STEICE - shall be an inactive, dummy receptacle.

(b) TMDE - shall be an inactive, dummy receptacle.

(c) Slave Receptacle - shall be an inactive, dummy receptacle.

(d) Power Ind light - shall be an dummy green indicator.

(e) Energize Slave Receptacle pushbutton - shall be an inactive, dummy pushbutton.

(61) NBC heater.

(a) NBC System Control Knob - shall be a dummy 2-position rotary knob.

(b) NBC Heater Indicator light - shall be a dummy green dome indicator.

(62) Not Used.

(a) deleted

(63) Driver's Intercom Switch Box.

(a) deleted

(b) deleted

(64) Deleted

(65) DISCH indicator - shall be a red lamp and shall be illuminated when the simulated fire suppression system halon has been discharged.

(66) MANUAL indicator - shall be a red lamp and shall be illuminated when the simulated fire suppression system is operating in manual mode.

30.1.2.1.2 Vehicle Commander's Station.

The following switches, controls, gauges, and lights shall be provided at the M2A2/M3A2 Vehicle Commanders station in the locations and panels as found in the actual M2A2/M3A2 BFV.

a. The following controls, indicators, and other pieces of equipment shall be simulated (functional).

(1) Turret Drive Warning lights - shall be 2 push-to-test red indicators. Each indicator shall be illuminated when turret power is on and either turret power is on and the indicator is pressed.

(2) Turret Position Indicator - shall be an assembly of 13 yellow indicators that replicates the corresponding actual display in the BFV. The indicator shall consist of an arrow shaped indicator in the center of 12 circular indicators arranged at 30 degrees intervals (like the hours on a clock face), each of which shall be labeled with a number from 1 to 12 corresponding to the clock position. The center arrow indicator and one of the 12 circular indicators shall be illuminated when turret power is on. The circular indicator illuminated shall be a function of the turret position relative to the hull: with 0 degrees turret rotation, the indicator labeled "12" shall be illuminated; with 30 degrees turret rotation, the indicator labeled "1" shall be illuminated, and so on.

(3) Stabilization indicator - shall be a yellow indicator which is on when turret power, turret drive,and stabilization switches are all on. The indicator shall also illuminate when turret power is on and the Fan-Lamp Test switch is in the LAMP TEST position.

(4) Slope Indicator - shall be a simulated ½ moon assembly which shall indicate simulated vehicle angle from level to 20 degrees. The assembly shall consist of 9 indicators positioned at 20, 15, 10, 5, 0, 5, 10, 15, and 20 degrees.

(5) Commander's Control Handle - shall be a 2 potentiometer assembly with left, right forward, and reverse motion. Movement of the handle left will cause the turret to rotate to the left (counterclockwise); moving the handle to the right will cause the turret to rotate to the right; moving the handle assembly forward will lower the turret elevation; and moving the handle assembly to the rear will raise the elevation of the turret.

(a) Trigger switch - shall be a red trigger -shaped pushbutton switch on top front of handle (above palm switch). When depressed this switch fires the selected weapon: 25mm gun; coax machine gun; TOW missile.

(b) Fast Turret switch (slew button) - shall be a pushbutton switch on the back of the handle which increases the speed of turret traverse from a range of 0.1 to 89 mils per second to a range of 0.1 to 1067 mils per second, the speed of the gun elevation from a range of 0.05 to 89 mils per second to a range of 0.05 to 1067 mils per second, and the speed of the TOW elevation from a range of 0.05 to 89 mils per second to a range of 0.05 to 267 mils per second.

(c) Palm switch - shall be a finger grip pushbutton switch on bottom front of handle which activates turret drive and releases turret drive brakes.

(d) Drift button - shall be a pushbutton on left side of handle base. When depressed this switch reduces the drift in the turret stabilization system.

(e) Commander’s Arm Rest - shall replicate the Commander’s Arm Rest in the BFV.

(6) Commander’s Intercom Control Box - shall consist of the following:

(a) Intercom Monitor switch - shall be a 5 position rotary switch with positions labelled ALL, A, INT ONLY, B, and C (clockwise from left position). In ALL position, allows monitor of all channels, in INT ONLY causes only the intercom to be monitored, and in A, B, C positions shall select the corresponding radio channel for monitoring.

(b) Volume knob - shall be a potentiometer with 270 degrees of rotation. Rotating the knob clockwise shall increase intercom volume, rotating the knob counterclockwise shall decrease the intercom volume.

(c) Right connector (J802) shall allow for connection of an CVC helmet. The right connector shall also be used to detect the forward (radio) CVC helmet switch position and interface to the CVC helmet microphone and earphones (for both simulated intercom and radio).

(d) Left connector (J803) shall allow for connection of an actual CVC helmet. The left connector shall also be used to detect the rear (intercom) CVC helmet switch position.

(7) Radio-Intercom switch - shall be a 3 position toggle labeled RADIO above and INTERCOM below and momentary in the RADIO position. This switch shall replicate the functionality of the corresponding switch in the actual M2A2/M3A2, which selects between the radio and the intercom.

(8) Turret Control Box.

(a) Turret Power switch - shall be a 2 position pull-to-toggle switch labeled ON above and OFF below and lever locked in the down (OFF) position. This switch shall replicate the functionality of the corresponding actual switch which controls power to the turret.

(b) Turret Power indicator - shall be a yellow indicator which shall be on when turret is on. The indicator shall also light when the Fan-Lamp Test switch is in the LAMP TEST position and vehicle power is on.

(c) Turret Drive System and Stabilization switches -

i. Turret Drive System switch - shall be a 2 position toggle switch labeled OFF below. This switch shall replicate the functionality of the corresponding actual switch which controls power for turret traverse, TOW launcher, and 25mm gun system.

ii. Turret Drive System indicator - shall be a yellow indicator and shall be on when turret power and turret drive switches are on and vehicle master power is on. This indicator shall also be on when the Fan-Lamp Test switch is in the LAMP TEST position, and turret power is on.

iii. Stabilization switch - shall be a 2 position toggle switch labeled STAB OFF below. In the on position, this switch shall turn on the stabilization control for turret drive and elevation which maintains turret on target while vehicle is moving.

(d) TOW Abort switch - shall be a 2 position pull-to-toggle switch which is momentary in the up position and locked in the down position, labeled TOW ABORT above. In the TOW ABORT position, this switch shall cause TOW missile wires to be cut, aborting the missile.

(e) Warning Indicators - the following annunciator indicators shall be illuminated when the Fan-Lamp Test switch is in the LAMP TEST position and turret power is on in addition to the conditions described below:

i. Open Hatch - shall be a yellow indicator labeled OPEN HATCH in center of indicator and shall be illuminated when turret power is on and any of the following are open: cargo hatch cover (virtual); turret shield door.

ii. Back Up Power - shall be a yellow indicator labeled BACK UP PWR in center of indicator, illuminated when emergency battery power is being used to operate firing control system, gunner’s handstation triggers, and communications systems and turret power is on.When this indicator is ON the turret drive shall not be able to be operated electrically.

iii. No Fire Zone - shall be a yellow indicator labeled in center of indicator. Illuminated when turret power is on and one or more weapons are in a position such that, if fired, damage to vehicle and injury to personnel could result. When this indicator is ON the trigger switches shall be inoperative.

iv. Manual Drive - shall be a yellow indicator labeled in center of indicator. Illuminated when a select lever is in manual mode and turret power is on.

v. Drive Malfunction - shall be a yellow indicator labeled in center of indicator, illuminated when drive system malfunction is active and turret power is on.

vi. Fan/Lamp Test switch - shall be a 3 position toggle switch labeled FAN above and LAMP TEST below and momentary down. In the FAN position this switch shall turn on the gun fans continuously. In center position, the gun fans shall be activated whenever gun fires. In LAMP TEST position, all indicator lights in turret shall be turned on, providing turret power is on.

(9) Commander's ISU

(a) Commander's sight extension with eye piece - replicate the commander's sight extension with eyepiece on the BFV. The eyepiece shall display scenes generated by the visual system as specified in Appendix A.

(b) Commander's ISU Focus barrel - shall replicate the appearance and movement of the corresponding actual control on the BFV and shall simulate focusing of the Commander's ISU sight.

(c) Brow pad - shall replicate the commander's ISU Brow Pad on the BFV. A sensor shall be provided to determine when the sight is in use. When activated, the Commander's ISU shall display simulated ISU imagery.

(10) Sight Reticle for 25mm Automatic Gun and 7.62 Coaxial Machine Gun with range and ammo indicators - shall be a graphics display which shall be overlayed on the graphical replication of the surrounding terrain viewed on the commander's ISU sight extension.

(11) TOW Sight Reticle with ammo indicators - shall be a graphics display which shall be overlayed on the graphical replication of the surrounding terrain.

(12) Dome light -

(a) Light Selector switch -shall be a 3 position rotary switch with blackout, white light and off positions. In the off position this switch shall turn off both the blackout and white lights. The other two positions shall turn on the associated lights.

(b) Blackout Release button - shall be a pushbutton switch, which, when depressed allows moving the Light Selector switch from blackout to white light position.

(c) White lamp - shall be illuminated whenever the Light Selector switch is in the white light position.

(d) Blackout lamp - shall be illuminated whenever the Light Selector switch is in the blackout position.

(13) Turret Azimuth Indicator - shall be a trainer unique panel with the following components:

(a) Azimuth shall be a 4 digit display used to to indicate the simulated position of the turret relative to the hull in the range of 10 to 6400 mils. The display shall indicate 6400 mils when the simulated position of the turret is aiming down the centerline of the vehicle.

(b) Text indicator shall consist of eight 5X7 dot matrix characters used to display text corresponding to the position ranges on the actual vehicle.

(14) Turret travel lock - shall be a 2 position lever. When in the LOCK position, shall prevent movement of turret.

(15) Combat Override - shall be a 2 position toggle switch labeled ON above and OFF below and magnetically held in ON position. Switch shall have a red safety cover. The magnetic hold for the ON position shall be turned off when Turret Power switch is in the OFF position. In the ON position, this switch shall disable the Turret Door, Driver's Hatch, and Cargo Hatch Interlock switches and allow turret operation when any of these are open.

(16) Commanders Hatch Assembly (Hatch cover, handle). For the Commander's Popped Hatch (CPH) version, the hatch cap, when closed, shall be able to be opened by handles. A hinging mechanism shall cause the cap to move to an opening of approximately four inches (this spacing shall replicate the actual vehicle). The popped hatch view shall cover a 360-degree field of view and shall be obstructed by structures replicating the vision block housings, machine gun mounts, commander's weapon sight tube, hatch hinge mechanisms, and a modified machine gun; when the cap is closed the module vision blocks shall use the same monitors to the same degree as in popped hatch mode.

(17) Commander's Seat - shall be a functional replica of the vehicle seat with the full range of motion and adjustment as in the actual M2A2/M3A2 BFV. The commander's seat assembly shall include a control handle, which, when pulled, releases the seat for height adjustment. The commander's seat shall be provided with a mechanically operative seatbelt.

(18) Audio frequency amplifier (AM 1780/VRC) shall be functionally replicated as follows:

(a) Main Power switch - shall be a 3 position rotary switch with positions labeled NORM, INT ONLY, and OFF. This switch shall replicate the functionality of the corresponding actual switch which controls the mode of the amplifier. With the switch in NORM, the radio and intercom audio shall be amplified; with the switch in INT ONLY, the intercom audio only is amplified; with the switch in OFF, amplification is deactivated.

(b) Int Accent switch - shall be a 2 position rotary switch with positions labeled ON and OFF. In the ON position, this switch shall reduce the volume of radio traffic below the volume of intercom traffic; while in the OFF position, the volumes shall be equal.

(c) Radio Trans switch - shall be a 3 position rotary switch with positions labeled CDR CREW, CDR ONLY, and LISTENING SILENCE. This switch shall replicate the functionality of the corresponding actual switch which controls radio transmission access. With the switch in CDR CREW position, all crew positions shall have the capability to transmit; with the switch in CDR ONLY, only the commander's position shall be able to transmit; with the switch in LISTENING SILENCE, no positions may transmit.

(d) Power Ckt Bkr switch - shall be a 2 position trippable toggle-type circuit breaker. This switch shall replicate the functionality of the corresponding actual switch which controls power to the amplifier. With this switch not tripped and master power on, the amplifier shall be operational.

(e) Power light - shall be a green lamp which shall be illuminated when master power is on and the Power Ckt Bkr switch is on (not tripped).

(f) Installation switch - shall be a 3 position rotary switch with positions labeled INT ONLY, OTHER, and RETRANS.

(19) Commander's Condition indicator - shall be a trainer unique 2 lamp assembly. An amber lamp shall be illuminated when the commander is considered to be wounded; a red lamp shall be illuminated when the commander is considered to be dead.

(20) Commander's Head Tracker - is a trainer unique item which shall provide feedback indicating the commander's head orientation and shall be used for vision block control.

(21) Binoculars (7X) (for CPH version only).

(a) Binocular capability shall be provided with each popped hatch module by a trainer unique device. A momentary pushbutton switch shall be provided which, when depressed, will enable the binocular capability on the CPH display.

(b) A two axis joystick shall be provided which, when the momentary pushbutton is depressed, shall slew the binocular reticle in azimuth and the CPH imagery in elevation.

(22) Night Vision Goggles (NVG) (for CPH version only).

(a) Night vision goggles shall be functionally replicated as follows:

A trainer unique momentary pushbutton switch shall be provided which will enable and disable the night vision capability. When the night vision capability is activated, the CPH shall display night vision imagery.

(b) Deleted.

(23) Commander's Vision Blocks - 7 vision blocks (periscopes) shall be provided to the commander which shall display scenes generated by the visual system as specified in Appendix A.

(24) Two SINCGARS radios (RT-1523A) shall be functionally and physically replicated. The SINCGARS radios shall be compatible with organizational requirements, except as indicated in 3.7.6, for vehicle and headquarters radio configurations and shall allow for communication with the Operations Center (OC) and other desired units. Each radio shall simulate the following controls:

(a) ANT connector shall be a dummy 3-D connector which shall have a dummy cable. On vehicular installations that provide a long range (lower) radio the dummy cable shall connect to the RF power amplifier. On the short range (upper) radio the dummy cable shall connect to the chassis (representing connecting to vehicle antenna).

(b) CHAN (channel) switch shall select manual, preset and cue channels. This switch shall be an 8 - position rotary switch with pointer knob which utilizes the following positions:

i. CUE - This position shall allow the operator to preset SC frequency for the CUE channel or select the preset CUE frequency.

ii. MAN - This position shall allow the operator to preset SC frequency for the MAN channel or select the preset MAN frequency.

iii. 1 - This position shall allow the operator to preset a SC frequency for channel 1. This position shall also select the preset SC frequency when in SC mode and the FH hopset when in FH mode for channel 1. The loading of preset FH channels or COMSEC keys shall be simulated using the external interface unit.

iv. 2 - This position shall allow the operator to preset a SC frequency for channel 2. This position shall also select the preset SC frequency when in SC mode and the FH hopset when in FH mode for channel 2. The loading of preset FH channels or COMSEC keys shall be simulated using the external interface unit.

v. 3 - This position shall allow the operator to preset a SC frequency for channel 3. This position shall also select the preset SC frequency when in SC mode and the FH hopset when in FH mode for channel 3. The loading of preset FH channels or COMSEC keys shall be simulated using the external interface unit.

vi. 4 - This position shall allow the operator to preset a SC frequency for channel 4. This position shall also select the preset SC frequency when in SC mode and the FH hopset when in FH mode for channel 4. The loading of preset FH channels or COMSEC keys shall be simulated using the external interface unit.

vii. 5 - This position shall allow the operator to preset a SC frequency for channel 5. This position shall also select the preset SC frequency when in SC mode and the FH hopset when in FH mode for channel 5. The loading of preset FH channels or COMSEC keys shall be simulated using the external interface unit.

viii. 6 - This position shall allow the operator to preset a SC frequency for channel 6. This position shall also select the preset SC frequency when in SC mode and the FH hopset when in FH mode for channel 6. The loading of preset FH channels or COMSEC keys shall be simulated using the external interface unit.

(c) RF PWR switch shall be a 4 position rotary switch with pointer knob, with the following positions:

i. LO - This position shall set the transmission power to low.

ii. M - This position shall set the transmission power to medium.

iii. HI - This position shall set the transmission power to high.

iv. PA - This position shall set the operation of transmissions for use with the power amplifier, or high power if power amplifier is not connected to the RT.

(d) MODE Switch - This switch shall be a 3 - position rotary switch with pointer knob, with the following positions:

i. SC - This position shall set the Receiver/Transmitter to SC (single channel) mode.

ii. FH - This position shall set the Receiver/Transmitter to FH (frequency hopping) mode.

iii. FH-M - This position shall set the Receiver/Transmitter to FH-M(frequency hopping master) mode. The operator shall be required to pull the switch to go into the FH-M position.

(e) RXMT connector shall be a dummy 3-D connector which shall have a dummy cable connected to the RXMT on the other RT in the radio mount.

(f) FCTN(function) Switch - This switch shall be a 9 - position rotary switch with pointer knob, with the following positions:

i. STBY - This position shall turn off receiver/transmitter (RT) while maintaining memory. The operator shall be required to pull the switch knob in order to go into the STBY position.

ii. TST - This position shall cause the normal self test indications to be displayed on the keyboard display.

iii. LD - This position shall allow the operator to load SC frequencies, and shall also allow the operator to receive ERF data from an RT operating in FH-M mode.

iv. SQ ON - This position shall turn on the RT and activate the squelch.

v. SQ OFF - This position shall turn on the RT and deactivate the squelch.

vi. RXMT - This position shall be non-functional.

vii. REM - This position shall disable the RT's front panel controls.

viii. Z-FH - This position shall clear the RT of all FH data. The operator shall be required to pull the switch knob in order to go into the Z-FH position.

ix. OFF - This position shall turn off all power to the RT. This function shall also erase the RT's memory. The operator shall be required to pull the switch knob in order to go into the OFF position.

(g) DIM Control - This shall be an active control which replicates the appearance and function of the corresponding actual knob.

(h) Keyboard Display shall display all information concerning the operation of the RT including SC frequencies, FH data, error messages, data rates as well as keyboard entries. The display shall consist of 8 full 5 X 7 dot matrix characters that are alphanumeric with the capability to display special characters. The seventh 5 X 7 dot matrix character shall be capable of displaying no dots on column number one, on column number two only displaying dots on rows one, three, five, and seven that have the capability to be lighted individually, no dots on column number three, and capable of lighting all the dots on columns four and five at the same time. The eighth dot matrix character shall also be capable of displaying dots arranged in the form of a diamond. All displays shall be dimmable. Color of display shall be green.

(i) Keypad shall be responsible for the entering data into the RT. The keypad shall consist of the following 16 pushbutton keys:

i. CMSC 1 - Shall display the COMSEC key identifier number on the display and enter the number '1' into the system.

ii. * 2 - Shall enter the number '2' into the system. The special feature activated by this key on the actual RT shall not be selectable or simulated.

iii. SYNC 3 - Shall place the RT into 'late entry' status allowing the RT to re-enter the network. Also shall enter the number '3' into the system.

iv. FREQ - Shall allow the operator to load and clear SC frequencies in the RT.

v. DATA 4 - Shall display the RT's operational data rate and enter the number '4' into the system.

vi. 5 - Shall enter the number '5' into the system.

vii. 6 - Shall enter the number '6' into the system.

viii. ERF OFST - Shall transmit ERF data to net members when RT is operating in FH-M mode. Also shall load/check SC offset frequencies.

ix. CHG 7 - Shall change current information on display to another available selection. Shall also enter the number '7' into the system.

x. 8 - Shall enter the number '8' into the system.

xi. LOUT 9 - Shall enter the number ’9’ into the system. Shall also retrieve frequency lockout sets from permanent memory if the RT is operating as Frequency HopMaster.

xii. TIME - Shall be used to check RT FH sync time clock.

xiii. CLR - Shall clear data from display if error was made during entry. Shall also clear data from RT memory.

xiv. LOAD 0 - Shall load data into holding memory in RT and to retrieve data from permanent memory into holding memory. Shall also enter the number ’0’ into the system.

xv. STO - Shall transfer data from RT holding memory onto permanent memory.

xvi. BATT CALL - Shall be non-functional.

(j) COMSEC switch shall be responsible for controlling the communication security modes of the RT. It shall be a 5 - position rotary switch with pointer knob, with the following positions:

i. PT - This position shall place the RT into plain text mode. The operator shall be required to pull the knob in order to place the knob into this position.

ii. CT - This position shall place the RT into cipher text mode.

iii. TD - This position shall be non-functional.

iv. RV - This position shall prepare the RT to receive a remote fill of COMSEC variables from the NCS.

v. Z - This position shall clear COMSEC keys. The operator shall be required to pull the knob in order to place the knob into this position.

(k) VOL/WHSP control shall be a rotational knob used for audio volume control. The knob shall also provide a pullout position which shall be non-functional.

(l) HUB Connector - Dummy cover that shall not be removable.

(m) AUD/FILL connector shall be a dummy 3-D connector.

(n) AUD/DATA connector shall be a dummy 3-D connector. In vehicular installations, a dummy 3-D cable shall connect to the AUD/DATA connector and the DATA A or DATA B connector of the mounting adapter.

(25) SINCGARS Radios shall be mounted in a short/long range radio configuration. This mounting shall replicate the AN/VRC-89A configuration which contains the following:

a. Amplifier-Adapter, Vehicular (mounting adapter) AM-7239B/VRC.
b. Amplifier, Radio Frequency AM-7238A/VRC.
c. Receiver-Transmitter, Radio RT-1523 A.
d. Receiver-Transmitter, Radio RT-1523 A.
e. Loudspeaker Control Unit, LS-671/U.

The Configuration shall be replicated as follows:

(a) The mounting adapter shall have two (2) SINCGARS receiver-transmitters as described above. The mounting adapter shall have a simulated Radio Frequency Amplifier connected, and shall also have the following components:

i. CB1 (power) switch shall be a two position trippable toggle switch with an ON and OFF position.

ii. Indicator lamp and lens shall be a green dimmable indicator. The indicator shall flash for 3 +/- 1 second after CB1 switch is moved to ON position, then stay lit. The lens shall allow the indicator to be dimmed by turning clockwise.

iii. The (AUD/DATA B J2) connector shall be a 3-D dummy connector.

iv. The (AUD/DATA A J3) connector shall be a 3-D dummy connector.

v. The (DATA B J4) connector shall be a 3-D dummy connector with a dummy cable connected to the AUD/DATA connector on the top radio.

vi. The (DATA A J5) connector shall be a 3-D dummy connector with a dummy cable connected to the AUD/DATA connector on the bottom radio.

vii. The (SPKR J6) connector shall be a 3-D dummy connector.

(b) The Radio Frequency Amplifier shall be connected to the mounting adapter. The Radio Frequency Amplifier shall have the following components.

i. The (J1) connector shall be a dummy connector. A dummy cable which represents the connection to a vehicle antenna shall be connected to the J1 connector.

ii. The (J2) connector shall be a dummy connector. A dummy cable which also connects to the ANT connector of the RT mounted in the bottom position of the mounting adapter shall be connected to the J2 connector.

(26) Commander’s NBC hookups are as follows:

(a) Commander’s NBC air hose shall be physically and functionally replicated.

(b) Commander’s NBC quick disconnect shall be physically and functionally replicated.

(c) Commander’s NBC air outlet hose clip shall be physically and functionally replicated.

(27) Precision Lightweight GPS Receiver (PLGR+96 SPS) shall be physically installed as in the operational unit, except where simulated vehicle space constraints apply and functionally replicated as described in paragraph 3.7.6.4.

b. The following controls, indicators, and other pieces of equipment shall be physically represented (operational but nonfunctional):

(1) NBC Heaters.

(a) Left NBC Heater knob - shall be a rotary switch which is labeled WARMER on right with an arrow wrapping clockwise, and labeled OFF on the left.

(b) Left NBC Heater lamp - shall be a dummy green lamp.

(c) Right NBC Heater knob - shall be a rotary switch which is labeled WARMER on right with an arrow wrapping clockwise, and labeled OFF on the left.

(d) Right NBC Heater lamp - shall be a dummy green lamp.

(2) Intercom Amplifier Box.

(a) Audio Input jacks - shall be a dummy 2 jack assembly labeled “AUDIO INPUT”.

(b) Line jacks - shall be a dummy 2 jack assembly labeled “TEL/REMOTE”.

30.1.2.1.3 Gunner’s Station.

The following switches, controls, gauges, and lights shall be provided at the Gunner’s station in the locations and panels as found in the actual M2A2/M3A2 BFV.

a. The following controls, indicators, and other pieces of equipment shall be simulated (functional).

(1) Switches, controls, and associated lights and indicators.

(a) Weapon Control Box - shall be functionally replicated. The following switches and indicators on the Weapon Control Box shall be replicated and function as described:

i. Arm-Safe-Reset switch - shall be a 3 position pull-to-toggle switch, lever-locked in center position and labeled ARM above, SAFE in center, RESET below. In the ARM position, this switch shall arm the 25mm gun, coax machine gun, and TOW missiles; SAFE position shall prevent firing; RESET shall clear all weapons selected. This switch shall be mechanically held in the ARM position and momentary in the RESET position.

ii. Sear Misfire button - shall be a pushbutton switch which when depressed shall bring 25mm gun bolt back to the SEAR position after trigger is depressed when the 25mm gun misfires.

iii. AP SS button - shall be a pushbutton switch which when depressed shall select 25mm gun AP single shot mode.

iv. AP SS indicator - shall be a yellow indicator which shall be illuminated only when AP single shot is selected.

v. AP LO button - shall be a pushbutton switch which when depressed shall select 25mm gun AP low rate (100 rounds per minute) mode.

vi. AP LO indicator - shall be a yellow indicator which shall be illuminated only when AP low rate is selected.

vii. AP HI button - shall be a pushbutton switch which when depressed shall select 25mm gun AP high rate (200 rounds per minute) mode.

viii. AP HI indicator - shall be a yellow indicator which shall be illuminated only when AP high rate is selected.

ix. HE SS button - shall be a pushbutton switch which when depressed shall select 25mm gun HE single shot mode

x. HE SS indicator - shall be a yellow indicator which shall be illuminated only when HE single shot is selected.

xi. HE LO button - shall be a pushbutton switch which when depressed shall select 25mm gun HE low rate (100 rounds per minute) mode.

xii. HE LO indicator - shall be a yellow indicator which shall be illuminated only when HE low rate is selected.

xiii. HE HI button - shall be a pushbutton switch which when depressed shall select 25mm gun HE high rate (200 rounds per minute) mode.

xiv. HE HI indicator - shall be a yellow indicator which shall be illuminated only when HE high rate is selected.

xv. 7.62 button - shall be a pushbutton switch which when depressed shall select 7.62mm machine gun

xvi. 7.62 indicator - shall be a yellow indicator which shall be illuminated only when 7.62mm machine gun is selected

xvii. LO Ammo Ovrd button - shall be a pushbutton switch which when depressed, shall allow the currently selected gun (25 mm, 7.62 mm) to fire the remaining ammo when LO AMMO indicator is flashing.

xviii. LO Ammo Ovrd indicator - shall be a yellow indicator which shall be illuminated and flashing at 1.6 Hz +/- 10% only when the end of the ammo belt passes the sensors on the ammo can. The indicator shall stop flashing when the LO AMMO OVRD button is pressed.

xix. Trigger button - shall be a pushbutton switch which when depressed shall fire all eight smoke grenades.

xx. Grenade Launcher ON/OFF switch - shall be a 2 position pull-to-toggle switch which shall arm and disarm the launcher by selecting power ON and OFF to the smoke grenade launcher.

xxi. GRENADE LAUNCHER indicator - shall be a yellow indicator which shall be illuminated only when the smoke grenade launcher is armed.

xxii. Arm indicator - shall be a red indicator which shall be illuminated only when a weapon is armed.

xxiii. SEAR indicator - shall be a yellow indicator which shall be illuminated only when 25mm gun bolt is in the SEAR position. This indicator shall blink at 1.6 Hz +/- 10% indicating the 25mm gun bolt is in the MISFIRE position.

xxiv. TRIGGER indicator - shall be a red indicator which shall be illuminated when the TRIGGER button is pressed.

xxv. PNL Light Dimmer knob - shall be a knob which shall replicate the appearance, movement, and function of the corresponding actual control. This knob shall variably adjust the panel lights on the Weapon Control

Box, Turret Control Box, TOW Control Box, and Turret Position Indicators from bright to dim.

(b) TOW Control Box.

i. TOW Test button - shall be a pushbutton switch which shall activate the TOW test mode for 20 seconds.

ii. TOW TEST indicator - shall be a yellow indicator which shall be illuminated while the TOW test mode is activated.

iii. Launcher UP/DN switch - shall be a 2 position pull-to-toggle switch which shall raise and lower TOW missile launcher when the palm switch on the commander's or gunner's control handles are pressed.

iv. Launcher UP/DN indicator - shall be a yellow indicator which shall be illuminated only when the missile launcher is raised.

v. TOW button - shall be a pushbutton switch which shall select the TOW mode. When the TOW mode is selected the TOW indicator shall be illuminated and the TOW test mode shall be activated for 20 seconds.

vi. TOW indicator - shall be a yellow indicator which shall be illuminated while the TOW mode is selected.

vii. MSL 1 button - shall be a pushbutton switch which shall select TOW missile launcher tube No. 1 for firing.

viii. MSL 2 button - shall be a pushbutton switch which shall select TOW missile launcher tube No. 2 for firing.

ix. Missile Tube 1 indicator - shall be a yellow indicator which shall be illuminated when TOW missile launcher tube No. 1 is selected and shall flash when the selected missile launcher tube is empty.

x. Missile Tube 2 indicator - shall be a yellow indicator which shall be illuminated when TOW missile launcher tube No. 2 is selected and shall flash when the selected missile launcher tube is empty.

xi. TOW 2 missile indicator - shall be a yellow indicator which shall be illuminated when a TOW 2 missile is loaded in the selected missile tube.

(2) Switches and Controls.

(a) Gunner's Handstation shall be functionally replicated with left and right Gunner's Control Handles. The following switches on the Gunner's Handstation shall be replicated and shall function as described :

i. Left and Right Trigger switches - shall be red momentary pushbutton switches which shall fire the currently selected weapon (25mm gun; coax machine gun; TOW missile).

ii. Left and Right Palm switches - shall be momentary pushbutton switches which shall activate turret drive system and release the turret drive brakes.

iii. Left and Right Fast Turret switches - shall be momentary pushbutton switches which shall activate turret drive system in fast mode.

iv. Drift button - shall be a pushbutton switch which shall reduce the drift in the turret stabilization system when depressed.

v. Handle Elevation control - shall be a potentiometer which shall rotate forward and aft to control elevation of the 25mm gun, 7.62mm machine gun, and the TOW launcher. When the Gunner's Control Handles are moved forward the elevation shall be decreased; when moved aft, the elevation shall be increased.

vi. Handle Traverse control - shall be a potentiometer which shall rotate left and right for control of turret azimuth. When the Gunner's Control Handles are rotated left and right, the turret shall traverse in the direction the handles were moved.

(b) Gunner's ISU and controls shall be functionally replicated. The following switches shall be replicated and function as described:

i. Gunner's ISU brow pad - shall replicate the gunner's ISU brow pad in the BFV.

ii. A sensor shall be provided to determine when the sight is in use and when activated, the gunner's ISU shall display simulated ISU imagery.

iii. Ret Brt knob - shall be a potentiometer which shall adjust the brightness of the reticule in the gunner's ISU eyepiece.

iv. Sensor Select switch - shall be a three position rotary switch which shall select the light filter settings for the ISU. "NIGHT" setting is for night vision system, and "CLEAR" and "NEUTRAL" are for daytime conditions.

v. Range Control knob and indicator - Range Control knob shall be a 16 position rotary switch which shall select the range of the 25mm and 7.62mm guns from 0 to 3000 meters. The range control knob shall be incremented from 0 to 30 by twos (0, 2, 4 . . . 30). The “0” marker shall be encircled. The “12” marker shall be enclosed in a diamond. The Range Control indicator shall be a yellow lamp at top of dial and shall illuminate the currently selected range. The Range Control knob shall replicate the Range Control knob on the BFV.

vi. Gun Boresight Controls - Azimuth control shall be a knob with 240 degrees of movement. The Azimuth control shall adjust the gun reticle in azimuth when in GUN (25mm or 7.62mm selected) mode. Elevation control shall be a knob with 350 degrees of movement. The Elevation control shall adjust the gun reticle in elevation when in GUN mode.

vii. Night Boresight Controls - Azimuth control shall be a knob with 7/8 +/- 1/8 revolutions of movement. The Azimuth control shall adjust the azimuth of the night vision scene. Elevation control shall be knob with 7/8 +/- 1/8 revolutions of movement. The Elevation control shall adjust the elevation of the night vision scene.

viii. Night Vision PLRT switch - shall be a 2 position toggle switch which shall select between “W/H” and “B/H” polarity setting for the night vision scene. “W/H” shall produce red images on black background and “B/H” shall produce black images on red background.

ix. Night Vision BRT knob - shall be a push-to-turn knob with 270 degrees of rotation which shall adjust night vision scene brightness.

x. Night Vision PWR switch - shall be a 3 position toggle which shall be labeled “ON”, “OFF”, and “BRSIT”. The switch shall turn on the night vision system in the “ON” position, turn off the night vision system in the “OFF” position, and turn on the boresight lamp in the “BRST” position. The switch shall be pulled to be moved to the “ON” position.

xi. Night Vision CON knob - shall be a push-to-turn knob with 270 degrees of rotation which shall adjust night vision scene contrast.

xii. Mag switch (4X, 12X) - shall be a 2 position rotary switch which shall select a HIGH and LOW magnification of both day and night vision scenes. LOW magnification shall be 4X and HIGH magnification shall be 12X.

xiii. Gun Reticle, TOW Reticle, Status indicator and Air Defense Reticle - shall be a graphics display which shall be overlayed on the display of the surrounding terrain.

xiv. RELAY AZ ADJ - shall be a knob which shall adjust the TOW reticle to EAR in azimuth.

xv. Day Sight Actuator handle - which rotates between two discrete positions to simulate opening and closing the day sight ballistic shield door. The handle shall be spring-loaded and lock in each of the two positions. The force required to move the handle to open position shall be 6 pounds +/- 2 pounds.

xvi. Night Sight Actuator handle - which rotates between two discrete positions to simulate opening and closing the night sight ballistic shield door. The handle shall be spring-loaded and lock in each of the two positions. The force required to move the handle to the open position shall be 10 pounds +/- 2 pounds.

xvii. Eye piece - shall replicate the gunner's ISU eyepiece on the BFV. The eye piece shall display scenes generated by the visual system as specified in Appendix A.

xviii. Unity Window - shall be a graphics display which replicates the Unity Window on the BFV. The simulated Unity Window shall display scenes generated by the visual system as specified in Appendix A.

(c) Gunner's Intercom Controls shall be functionally replicated. The following components shall be replicated and shall function as described:

i. Intercom Monitor switch - shall be a 5 position rotary switch with positions labelled ALL, A, INT ONLY, B, and C (clockwise from left position). ALL position shall allow monitor of all channels, INT ONLY shall cause only the intercom to be monitored, and in A, B, C positions shall select the corresponding radio channel for monitoring.

ii. Volume knob - shall be a potentiometer with 270 degrees of rotation. Rotating the knob clockwise shall increase intercom volume; rotating the knob counterclockwise shall decrease the intercom volume.

iii. Gunner's Floor switch - shall be a pushbutton switch which, when depressed, shall allow the gunner to speak over the intercom.

iv. Right connector (J802) shall allow for connection of an actual CVC helmet. The right connector shall also be used to detect the forward (radio) CVC helmet switch position and interface to the CVC helmet microphone and earphones (for both simulated intercom and radio).

v. Left connector (J803) shall allow for connection of an actual CVC helmet. The left connector shall also be used to detect the forward (radio) CVC helmet switch position and interface to the CVC helmet microphone and earphones (for both simulated intercom and radio).

(3) Lights.

(a) Annunciator Box shall be functionally replicated. The following switches and indicators on the Annunciator Box shall be replicated and function as described:

i. TOW CKT OPEN indicator - This yellow indicator shall be one discrete output and shall be illuminated when a malfunction exists in the TOW electrical system.

ii. AMMO SW REVERSE indicator - This yellow indicator shall be illuminated only when the “AP” and “HE” ammo switches are reversed.

iii. OPEN HATCH indicator - This yellow indicator shall be illuminated only when any of the following are open: the driver’s hatch cover; cargo hatch cover; turret shield door.

iv. NO FIRE ZONE indicator - This yellow indicator shall be illuminated only when weapons are in a position where they could damage the vehicle or personnel. When the “NO FIRE ZONE” annunciator indicator is on, the trigger switches shall be inoperable.

v. 25 FDR MALF indicator - This yellow indicator shall be one discrete output and illuminated only when a malfunction occurs in the 25mm gun feeder.

vi. 25 GUN MALF indicator - This yellow indicator shall be one discrete output and shall be illuminated only when a malfunction occurs with the 25mm gun.

vii. MANUAL DRIVE indicator - This yellow indicator shall be one discrete output and shall be illuminated only when a drive selector lever is in the manual mode.

viii. DRIVE MALF indicator - This yellow indicator shall be one discrete output and shall be illuminated only when a malfunction occurs in the drive system.

(b) TOW Control Box

i. ISU indicator - This yellow indicator shall be one discrete output and shall be illuminated when a malfunction occurs in the Integrated Sight Unit.

ii. DCGE indicator - This yellow indicator shall be one discrete output and shall be illuminated when a malfunction occurs in the Digital Command Guidance Electronics.

iii. PCU indicator - This yellow indicator shall be one discrete output and shall be illuminated when a malfunction occurs in the Power Control Unit.

iv. BAT indicator - This yellow indicator shall be one discrete output and shall be illuminated when a malfunction occurs in the batteries.

(c) Dome light -

i. Light Selector switch - shall be a 3 position rotary switch with blackout, white light and off positions. In the off position this switch shall turn off both the blackout and white lights.

ii. Blackout Release button - shall be a pushbutton switch which, when depressed, allows moving the Light Selector switch from blackout to white light position.

iii. White lamp - shall be illuminated whenever the Light Selector switch is in the white light position.

iv. Blackout lamp - shall be illuminated whenever the Light Selector switch is in the blackout position.

(4) Select Lever Controls

(a) Turret Traverse Drive Select Lever - shall be a two position lever switch with pushbutton lock at end of lever, which shall select between power and manual mode for turret traversing. In manual mode, the electrical motor shall be functionally disabled. The force required to move the lever from the power position to the manual position shall be 7 +/- 4 lbs.. The force required to move the lever from the manual position to the power position shall be 5 +/- 2 lbs. The force required to push the pushbutton lock shall be 6 pounds +/- 2 pounds.

(b) TOW Elevation Drive Select Lever - shall be a two position lever switch with pushbutton lock at end of lever, which shall select between power and manual mode for TOW elevation and depression. In manual mode, the TOW electrical motor shall be functionally disabled. The force required to move the lever from the power position to the manual position shall be 4 pounds +/- 2 pounds.

The force require to move the lever from the manual position to the power position shall be 4 pounds +/- 2 pounds. The force required to push the pushbutton lock shall be 6 pounds +/- 1 pound.

(c) Gun Elevation Drive Select Lever - shall be a two position lever switch with pushbutton lock at end of lever, which shall select between power and manual mode for elevation and depression of the 25mm gun and 7.62mm machine gun. In manual mode, the electrical motor shall be functionally disabled. The force required to move the lever from the power position to the manual position shall be 10 pounds +/- 2 pounds. The force require to move the lever from the manual position to the power position shall be 10 pounds +/- 2 pounds. The force required to push the pushbutton lock shall be 6 pounds +/- 1 pound.

(d) Turret Position indicator - shall be an assembly of 13 yellow indicators replicating the turret position indicator in the BFV. The indicator shall consist of an arrow shaped indicator in the center of 12 circular indicators arranged at 30 degrees intervals (like the hours on a clock face), each of which shall be labeled with a number from 1 to 12 corresponding to the clock position. The center arrow indicator and one of the 12 circular indicators shall be illuminated when turret power is on. Which of the 12 circular indicators is illuminated shall be a function of the turret position relative to the hull. With 0 degrees turret rotation, the indicator labeled “12” shall be illuminated; with 30 degree turret rotation, the indicator labeled “1” shall be illuminated, and so on.

(e) deleted

(f) Gun Elevation indicator - shall be a 4 digit display and shall have the ability to indicate the gun elevation from -160 to 1049 mils. The gun elevation indicator shall indicate the simulated elevation of the 25mm gun and coax machine gun in tens of mils.

(5) Gunner’s Handwheel Controls.

(a) Turret Traverse Handwheel and Trigger switch - Turret Traverse Handwheel shall be a 360 degree continuous rotation assembly with handle and spring, which shall simulate manually traversing the turret right or left. The force required for handwheel movement shall be 4.0 +/- 1 lbs. measured at the handle. Trigger switch shall be a pushbutton which shall fire the selected weapon (25mm, coax machine gun, TOW missile).

(b) Gun Elevation Handwheel - shall be a 360 degree continuous rotation assembly with handle and spring, which shall simulate manually elevating and depressing the 25mm gun, coax machine gun, and the TOW missile. The force required for handwheel movement shall be 7 pounds +/- 1 pound measured at the handle.

(6) Gunner’s Vision Blocks - 2 vision blocks (periscopes) shall be provided to the gunner Each vision block shall be provided with an “In-use” sensor. When either sensor is activated, the associated vision block shall display scenes generated by the visual system as specified in Appendix A

(7) Backup Sight - shall replicate the appearance and movement of the backup sight on the BFV. The backup sight shall be a display assembly with lock lever, flange joint, eyecup, eyepiece assembly, focus barrel, and sight reticle. The eyepiece shall be rotatable to either gunner’s or commander’s position. The eyepiece assembly shall simulate focus adjustment of the backup sight +/- 4 diopters. The sight shall display scenes generated by the visual system as specified in Appendix A.

(a) A sensor shall be provided to determine when the sight is in use and when activated, the gunner’s Backup Sight shall display simulated Backup Sight imagery.

(8) Gunner’s seat - shall be a functional replica of the vehicle seat with full range of motion and adjustment as in the actual M2A2/M3A2 BFV. The gunner’s seat assembly shall include a control handle which, when pulled, releases the seat for height adjustment. The gunner’s seat shall be provided with a mechanically operative seat belt.

(9) Gunner’s Condition indicator - shall be a trainer unique 2 lamp assembly with one discrete output per each lamp. An amber lamp shall be illuminated when the gunner is considered to be wounded; a red lamp when the gunner is considered dead.

(10) Deleted

(11) Gunner’s ISU Focus barrel - shall replicate the appearance and movement of the corresponding actual control on the BFV and shall simulate focusing of the Gunner’s ISU sight.

(12) Gunner’s ISU Focus knob shall be non-functional.

(13) Gunner’s NBC hookups are as follows:

(a) Gunner’s NBC air hose shall be physically and functionally replicated.

(b) Gunner’s NBC quick disconnect shall be physically and functionally replicated.

(c) Gunner’s NBC air outlet hose clip shall be physically and functionally replicated.

(14) Left and right machine gun door handles - shall replicate the operation of the left and right machine gun door handles on the BFV.

(15) Deleted

(16) Deleted

(17) Turret Shield Door and latch - shall be physically and functionally replicated.

b. The following controls, indicators, and other pieces of equipment shall be physically represented (operational but nonfunctional):

(1) Switches and controls.

(a) Gunner’s ISU and controls.

i. Fan Defogger Box with switch - shall be a dummy replica of the corresponding actual switch.

The gunner’s station shall be provided the current status of the available ammunition for the weapons listed in I.30.1.1.3. This ammunition status shall be based on the initialization ammunition minus the expended ammunition plus any resupplied and re-stocked ammunition. Reloading of the weapons shall be simulated by activation of a switch or button and then waiting the appropriate time delay for actually reloading the weapon. During this time delay the particular weapon shall not be capable of firing.

30.1.2.1.4 Troop Compartment.

The following controls, switches, gauges, and lights shall be provided in the troop compartment at the locations as found in the actual M2A2 BFV. The troop compartment shall be a framework that supports the replicated crew compartment equipment.

a. The following controls, indicators, and other pieces of equipment shall be simulated (functional):

(1) Dome Lights - three dome lights shall be replicated in the crew compartments. The domes lights shall be located in positions similar to the M2A2 BFV. Each crew dome light shall include the following:

(a) Light Selector switch -shall be a 3 position rotary switch with blackout, whitelight and off positions. In the off position this switch shall turn off both the blackout and white lights. The other two positions shall turn on the associated lights.

(b) Blackout Release button - shall be a pushbutton switch, which, when depressed allows moving the Light Selector switch from blackout to white light position.

(c) White lamp - shall be illuminated whenever the Light Selector switch is in the white light position.

(d) Blackout lamp - shall be illuminated whenever the Light Selector switch is in the blackout position.

(2) Deleted

(3) Fuel Filler Combat lock handle - shall be a mechanical component which replicates the appearance and movement of the corresponding actual handle. In the “IN” position, the handle shall simulate unlocking the fuel filler cover. In the “OUT” position, the handle shall simulate locking the fuel filler cover.

(4) Crew Intercom - shall consist of 3 intercom control boxes, each of which shall allow connection to a CVC helmet or a squad headset. Each intercom control box shall include the following:

(a) MONITOR switch - shall be a 5 position rotary switch with positions labelled ALL, A, INT ONLY, B, and C (clockwise from left position). ALL position, shall allow monitor of all channels, INT ONLY shall cause only the intercom to be monitored, and in A, B, C positions selects the corresponding radio channel for monitoring.

(b) Volume knob - shall be a potentiometer with 270 degrees of rotation. Rotating the knob clockwise shall increase intercom volume; rotating the knob, counterclockwise shall decrease the intercom volume.

(c) Right connector (J802) shall allow for connection of an actual CVC helmet. The right connector shall also be used to detect the forward (radio) CVC helmet switch position and interface to the CVC helmet microphone and earphones (for both simulated intercom and radio).

(d) Left connector (J803) shall allow for connection of an actual CVC helmet. The left connector shall also be used to detect the rear (intercom) CVC helmet switch position.

(5) Troop seats - shall consist of seating for 3 individuals.

(6) CARGO DOOR - shall be a trainer unique pushbutton switch. When depressed, this switch shall initiate the virtual task of opening the cargo door when closed or closing the cargo door when open. This switch shall also activate the cargo hatch opening and closing sound cues.

(7) Deleted

30.1.2.1.5 Vehicle Weapons.

The following additional controls, switches, gauges, and lights shall be provided at the locations as found in the actual M2A2 /M3A2 BFV.

a. The following controls, indicators, and other pieces of equipment shall be simulated (functional):

(1) M242 25mm Machine Gun manual controls.

(a) Ammo selector switch - shall be two 2 position toggle switches on turret basket labeled HE above and AP below which signal to the ISU which type of ammo is loaded in the corresponding ammo ready box.

(2) M240C 7.62mm Machine Gun manual controls.

(a) Firing Solenoid - shall be a non-functional space constraint.

(b) Deleted

(c) Coaxial machine gun charging cable and handle shall be physically replicated. Activation of the handle shall clear a 7.62mm machine gun misfire.

(d) Deleted

(e) Deleted

(3) TOW missile system shall be simulated functionally. The TOW launcher and missiles shall be virtual (no physical hardware). The TOW missile guidance shall take into account loss of control and wire breaks when gunner control inputs cause missile flight corrections which exceed tracking and guidance limitations. TOW missile dynamics shall accurately simulate the actual missile's response to the flight corrections from the gunner controls inputs. TOW controls are listed in section 3.1.2.1.3 (Gunner's Station).

(4) M257 smoke grenade launcher system shall be simulated functionally. The launcher and grenades shall be virtual (no physical hardware).

b. The following trainer unique controls shall be provided within the simulator module to allow loading of weapons with ammunition:

(1) AP AMMUNITION BOX STATUS Panel - shall be a trainer unique panel used to monitor the ammo status and control the loading of the 25mm AP ammo ready box. The panel shall contain the following:

(a) ROUNDS IN AP AMMO BOX shall be a 3 digit display used to indicate the number of rounds loaded in the 25mm AP ammo ready box.

(b) LOAD/UNLOAD shall be a pushbutton switch that indicates the virtual task of loading the 25mm gun with the ammunition in the AP ammo ready box. This switch shall be active only when the turret is stationary and within the range of 4000 to 4533 mils.

(c) HE LOADED shall be a green indicator that illuminates when HE rounds are loaded in the 25mm gun from the AP ammo ready box. The indicator shall flash during the simulated load time.

(d) AP LOADED shall be a green indicator that illuminates when HE rounds are loaded in the 25mm gun from the AP ammo ready box. The indicator shall flash during the simulated load time.

(e) UNLOADED shall be a green indicator that illuminates when the 25mm gun is unloaded from AP ammo ready box. This indicator shall flash during the simulated unload time.

(2) TOW STATUS PANEL - shall be a trainer unique panel that is used to monitor the status of the number of TOW rounds in storage and control the loading and unloading of the TOW launcher. The panel shall contain the following:

(a) TOW ROUNDS IN STORAGE shall be a two digit indicator which indicates the number of tow rounds in storage.

(b) LAUNCHER 1 LOAD/UNLOAD shall be a pushbutton switch that when depressed will initiate the virtual task of loading a round in the Number 1 TOW launcher tube if unloaded and unloading the Number 1 TOW launcher if loaded. This switch shall be active only when the cargo door is open and the launcher is in the load position.

(c) LAUNCHER 2 LOAD/UNLOAD shall be a pushbutton switch that when depressed will initiate the virtual task of loading a round in the Number 2 TOW launcher tube if unloaded and unloading the Number 2 TOW launcher if loaded. This switch shall be active only when the cargo door is open and the launcher is in the load position.

(d) LAUNCHER 1 LOADED shall indicate that the Number 1 TOW launcher is loaded. The indicator shall flash during the simulated TOW load time.

(e) LAUNCHER 1 UNLOADED shall indicate that the Number 1 TOW launcher tube is unloaded. During a virtual TOW unload task, the indicator shall flash during the simulated TOW unload.

(f) LAUNCHER 2 LOADED shall indicate that the Number 2 TOW launcher is loaded. The indicator shall flash during the simulated TOW load time.

(g) LAUNCHER 2 UNLOADED shall indicate that the Number 2 TOW launcher tube is unloaded. During a virtual TOW unload task, the indicator shall flash during the simulated TOW unload.

(3) HE AMMUNITION BOX STATUS Panel - shall be a trainer unique panel used to monitor the ammo status and control the loading of the 25mm HE ammo ready box. The panel shall contain the following:

(a) ROUNDS IN HE AMMO BOX shall be a 3 digit display used to indicate the number of rounds loaded in the 25mm HE ammo ready box.

(b) LOAD/UNLOAD shall be a pushbutton switch that indicates the virtual task of loading the 25mm gun with the ammunition in the HE ammo ready box. This switch shall be active only when the turret is stationary and within the range of 1867 to 2400 mils.

(c) HE LOADED shall be a green indicator that illuminates when HE rounds are loaded in the 25mm gun from the HE ammo ready box. The indicator shall flash during the simulated load time.

(d) AP LOADED shall be a green indicator that illuminates when HE rounds are loaded in the 25mm gun from the HE ammo ready box. The indicator shall flash during the simulated load time.

(e) UNLOADED shall be a green indicator that illuminates when the 25mm gun is unloaded from HE ammo ready box. This indicator shall flash during the simulated unload time.

(4) 25mm ROUNDS IN STORAGE Panel - shall be a trainer unique panel that is used to monitor the status and initiate the transfer of rounds from the ammo storage area to the ammo ready boxes. The panel shall contain the following:

(a) AP indicator shall be a four digit display used to indicate the number of AP rounds in storage.

(b) AP FILL ACTIVE AMMO BOX shall be a pushbutton switchlamp that when depressed shall initiate transfer of AP rounds to the currently selected ammo box (based on turret position). The switchlamp shall flash during the simulated transfer time.

(c) HE indicator shall be a four digit display used to indicate the number of HE rounds in storage.

(d) HE FILL ACTIVE AMMO BOX shall be a pushbutton switchlamp that when depressed shall initiate transfer of HE rounds to the currently selected ammo box (based on turret position). The switchlamp shall flash during the simulated transfer time.

30.1.2.1.6 Trainer Unique - Common.

a. The following controls, indicators, and other pieces of equipment shall be trainer unique equipment, common to all manned modules, and shall be provided in the M2A2/M3A2 simulator module.

(1) Simulated compass (grid azimuth indicator) - shall be a three digit display depicting the orientation of the long axis of the vehicle on the simulated terrain referenced to grid north. The simulated compass shall be available inside the compartment only after the vehicle has been stationary for 15 seconds.

30.1.2.2 External Interface Unit.

The M2A2/M3A2 manned module shall be provided with an External Interface Unit (EIU) that consists of an entry device and display device. The following information shall be displayed:

a. Exercise number,

b. Vehicle identification number.

The EIU shall be used to control and monitor the following M2A2/M3A2 functions:

a. Assessment of damages,

b. Initiation and termination of self-repairs,

c. Initiation and termination of fuel transfers,

d. Initiation and termination of ammo transfers,

e. Activate TOW MANUAL LIFT release handle,

f. Connection and disconnection of a tow kit to another vehicle,

g. External munition loading,

h. Load SINCGARS hopset and COMSEC data.

APPENDIX J
M1A2 MANNED MODULE

10. Scope.

This appendix establishes requirements for the M1A2 manned module.

20. Applicable Documents.

20.1 Government Documents.

(This section is not applicable to this appendix.)

20.2 Non-government Documents.

SSDD-00001 Version 6.0 February 1993	-	SYSTEM/SEGMENT DESIGN DOCUMENT FOR THE M1A2 MAIN BATTLE TANK VOLUME 3 SOLDIER / MACHINE INTERFACE

30. Requirements.

30.1 M1A2 Simulator Module.

The M1A2 simulator shall be designed to replicate the performance characteristics of the M1A2 vehicle and associated systems as described in paragraphs J.30.1.1 through J.30.1.2.3. These characteristics shall enable the M1A2 simulators to operate in the CCTT environment and shall provide the manned crew the system performance specified herein.

30.1.1 Performance Characteristics.

The following paragraphs contain the minimum detailed performance requirements that shall be provided with the M1A2 manned module. The M1A2 manned module shall also meet the generic design requirements of paragraph 3.6.

30.1.1.1 Deleted.

30.1.1.2 Fire Control System.

The vehicle weapons system for the M1A2 manned module shall have the capability for target sighting, aiming and firing of the 120mm Main Gun, M240 7.62mm Coaxial Machine Gun, M2 .50 Cal. Machine Gun and M250 Smoke Grenade Launchers. The simulated vehicle weapons system components shall replicate the operational equipment in both design and performance. The simulated fire control system shall accurately incorporate sighting reticles and fire control models and shall enable precision gunnery techniques in simulated battlefield environments. The fire control system shall consist of:

a. Gunner’s Primary Sight (GPS),

b. Gunner’s Auxiliary Sight (GAS) with browpad,

c. Gunner’s Control and Display Panel (GCDP),

d. Gunner’s control handle assembly (GCHA),

e. Laser Range Finder (LRF),

f. Commander’s GPS Extension (GPSE),

g. Commander’s control handle assembly (CCHA),

h. Improved Commander’s Weapon Station (ICWS),

i. Commander’s Independent Thermal Viewer (CITV).

These components in combination with the other simulated systems in the M1A2 simulation system shall provide the crew the capability to engage targets from a stationary position with a precision that matches real world results.

30.1.1.3 M1A2 Weapons and Ammunition.

The M1A2 simulation system shall simulate the following weapons and ammunition:

a. 120mm Main Gun,

(1) M829 APFSDS-T Cartridge,

(2) M830 HEAT-MP-T Cartridge,

b. M240 7.62mm Coaxial Machine Gun, A141, Ball, Tracer,

c. M2 0.50 caliber Machine Gun, (A534 API-T),

d. M250 smoke grenade launcher system, using the L8A3 RP smoke grenades.

30.1.1.4 Support Systems.

30.1.1.4.1 Electrical System.

The electrical system shall be capable of the following operating states:

a. Engine off, master power off.

b. Engine off, master power on, turret power on.

c. Engine running, alternator working, turret power on.

d. Engine running, alternator broken, turret power on.

e. Engine off, master power on, turret power off.

f. Engine running, alternator working, turret power off.

g. Engine running, alternator broken, turret power off.

Based on which operating state the electrical system is in, the associated problems and abilities shall be reflected in the M1A2 simulation system. These problems and abilities shall be replicated in the M1A2 simulation systems just as they would occur in the operational equipment.

30.1.1.4.2 Hydraulic System.

The hydraulic system shall cover the use of both the main and the auxiliary hydraulic pumps. The operation of slewing of the turret, elevation of the gun, the opening and closing of the ammunition door, and the setting of the parking brake shall take into account the status of the hydraulic system. The operation of the two hydraulic pumps and associated systems shall be reflected in the M1A2 simulation system replications of the operational equipment.

30.1.1.5 Depletable Resource Management.

Depletable resources management shall cover the management, consumption, and resupply of both fuel and ammunition. The fuel for the M1A2 simulation system shall be based on the use of three fuel tanks as found in the actual M1A2 tank. The management of maintaining fuel in the rear tank and the associated transfer of fuel from the own fuel tanks shall be the responsibility of the tank crew through normal operations at their respective stations. The resupply of fuel shall be accomplished through coordination with the ALOC and shall occur with the use of a fuel carrier. The ammunition for the M1A2 simulation system shall be based on the storage capabilities of the actual M1A2 tank for weapons and ammunition identified in paragraph J.30.1.1.3. The identification, transfer and resupply of ammunition shall be the responsibility of the Loader. In all cases, the monitoring of, use of and resupplying of the M1A2 tank's fuel and ammunition shall be based on the implementation of representative time and depletion parameters. The resupply operations shall include:

a. Simulated transfer for:

   (1) Fuel from one internal tank to another within a module

   (2) Fuel from a fuel carrier and pre-stock to the M1A2 tank

   (3) Ammunition from the ready rack to the breach

   (4) Ammunition from the semi-ready rack to the ready rack

   (5) Ammunition from the hull storage rack to the ready rack

   (6) Ammunition from an ammunition truck, M1A1, another M1A2, and Manned Module with comparable ammunition

   (7) Ammunition from prepositioned ammunition stocks

   (8) Reload times for the weapons listed in paragraph J.30.1.1.3

b. Depletion rates

(1) Fuel quantity and usage related to tank usage

(2) Ammunition quantity for the various weapons listed in paragraph J.30.1.1.3

30.1.1.6 Damage and Failure.

The list of components that are modeled for combat damage, stochastic failure, and deterministic failure shall be as defined in Table J-I.

Table J-I. M1A2 Failures and Damage

Component/System	Deterministic	Stochastic	Combat Damage
Air Filter		X	
Altenator		X	X
Antenna A and B			X
Auxiliary Hydraulic Pump		X	
Batteries		X	X
CITV		X	X
Commander's Integrated Display		X	
Cmdr's Power Control Handle		X	
Coax Gun Inoperative			X
Commander			X
Driver			X
Driver's Integrated Display		X	
Drown	X		
Electronics			X
Engine Assembly			X
Engine Loss of Power		X	
Engine Oil Filter		X	
Engine Oil Pump		X	
Engine Oil System			X
Engine Pilot Relay		X	
Engine Shutdown		X	
Engine Starter	X	X	X

Table J-I. M1A2 Failures and Damage			
Component/System	**Deterministic**	**Stochastic**	**Combat Damage**
Fire Control Electronics Unit		X	
Fuel Filter		X	
Fuel Transfer Motor		X	
GPS Both		X	X
GPS Day		X	X
GPS Thermal		X	X
Gun Azimuth Gyro	X	X	
Gun Elevation Gyro	X	X	
Gun Turret Hydraulics		X	
Gunner			X
Gunner’s Control Display Panel		X	
Gunner’s Power Control Handles		X	
Hull Ammunition			X
Hydraulics			X
Ignitor		X	
Intercom			X
IVIS Core		X	X
Left Idler Wheel			X
Left Roadwheel 1			X
Left Roadwheel 2			X
Left Roadwheel 3			X
Left Roadwheel 4			X
Left Roadwheel 5			X
Left Roadwheel 6			X
Left Roadwheel 7			X
Left Sprocket			X
Left Track	X	X	X
Loader			X
Machine Gun Inoperative			X

Table J-I. M1A2 Failures and Damage			
Component/System	**Deterministic**	**Stochastic**	**Combat Damage**
Main Gun Inoperative		X	X
NBC			X
Normal Mode			X
Oil Cooler		X	
Oil Cooler Fan		X	
Parking Brake		X	
Posnav		X	X
Radio A			X
Radio B			X
Regulator		X	
Right Idler Wheel			X
Right Roadwheel 1			X
Right Roadwheel 2			X
Right Roadwheel 3			X
Right Roadwheel 4			X
Right Roadwheel 5			X
Right Roadwheel 6			X
Right Roadwheel 7			X
Right Track	X	X	X
Rollover	X		
Transmission Assembly		X	X
Transmission Oil Filter		X	
Transmission Oil System			X
Turret Ammo Ready			X
Turret Ammo Semi			X
Turret Ammunition			X

30.1.1.7 Sound Generation System.

A sound and acoustic vibration generation system shall be provided. The sound system shall be completely separate from the communication system, and the sounds and vibrations shall be presented independently from any headphone system (i.e. multiple loudspeakers). The sounds and vibrations shall be of such fidelity,

quality, realism, and volume that crew members shall experience the cues, stresses, and distractions of a "real life" combat situation. The sounds shall be of sufficient volume so that the distractions provided to the crew members shall equal that found in an actual situation, but in no case shall 95 dB be exceeded for steady state noise (measured external to the CVC helmet). Table G-II lists the sound cues that shall be provided in the M1A1 simulation system.

Table J-II. M1A2 Sound Cues

SOUND CUE
Engine start to idle
Engine stop
Engine noise related to Revolutions Per Minute (RPM)
Transmission noise related to RPM
Parking brake set
Parking brake release
Track noise related to speed for terrain types simulated in CCTT.
Track popping (about to be thrown)
Turret traverse noise related to turret RPM
Main gun couple
Main gun uncouple
Gun elevate
Gun hitting upper or lower limits
Open Breech/ load round/ close breech
Close Breech/ unload round/ close breech
Fuel transfer pump
Auxiliary hydraulic pump
NBC system main and coax blower
Collisions with objects (scraping and hard collisions)
Commander's Independent Thermal Viewer (CITV) Power Up
CITV Power Down
CITV Running
Forward Area Air Defense (FAAD) Alert Tone
General Warning Tone
Gyros spinning/powered up
Fire main gun / discharge casing
Fire .50 caliber machine gun
Fire 7.62 mm machine gun

Table J-II. M1A2 Sound Cues
SOUND CUE
Fire smoke grenade launcher
Friendly and hostile main gun fire
Friendly and hostile missile launch
Friendly and hostile rocket launch
Generic explosive round (main gun, missile, rocket) hit
Generic explosive round (main gun, missile, rocket) miss
Friendly and hostile machine gun fire - large caliber
Friendly and hostile machine gun fire - small caliber
Friendly and hostile mine hit
Friendly and hostile bomb hit
Friendly and hostile bomb miss
Friendly and hostile artillery hit
Friendly and hostile artillery miss
Wheeled vehicle - large class
Wheeled vehicle - small class
Tracked vehicle
Aircraft - rotary wing class
Aircraft - fixed wing class
Bilge pump

30.1.1.7.1 Sound Synchronization.

The sound system shall be synchronized with the visual displays and the M1A2 controls within the system latency requirements, as defined in paragraph 3.2.2.1, and within the module latency requirements, as defined in paragraph 3.2.2.2.

30.1.1.7.2 Sound Generator.

During real-time operation, the desired sounds shall be stored in the sound system and shall be instantly available in real-time to the vehicle simulator module. The system shall provide outputs for driving speakers and subwoofers. The sound generation system shall have the ability of generating a minimum of eight sounds simultaneously with full parametric control of frequency and volume. Where appropriate, sound generation channels shall be “shared” by several different sounds on a priority basis. The number of sound generation channels shall be expandable to allow for future needs that may require the capability to generate a larger number of sounds simultaneously.

30.1.1.7.3 Sound Storage.

The M1A2 simulation system shall have the capacity to store all sound data and shall be expandable to allow for future increases in storage that would be necessary to generate a larger base of sound data.

30.1.1.7.4 Spatial Positioning.

The sound system shall provide for spatial positioning of the sound cues. The sounds shall be synchronized with the actions causing the sounds and shall be presented to allow personnel the ability to identify the distance (amplitude and time delay) of the events causing the sounds. For the Popped Hatch speakers, the sounds shall be synchronized with the actions causing the sounds and shall be presented to allow personnel the ability to identify the direction of the events causing the sounds.

30.1.1.7.5 Audio Amplifiers.

The audio amplifiers shall be of sufficient quality and power-handling ability to recreate the required volume levels without distortion greater than 0.05 percent Total Harmonic Distortion (THD) over the dynamic range.

30.1.1.7.6 Speakers.

The speaker configuration for each manned module shall be as defined in Table J-III. Audio cues shall be presented via speakers contained in each of the manned module crew compartments. Headphones shall not be required to present the ambient “sounds of battle.” Vibration cues (e.g. vehicle vibrations, weapons fire, and vibrations from explosions) shall be presented to the crew members through the use of subwoofers. Popped hatch speaker placement within the modules shall support spatial positioning.

Table J-III. M1A2 Module Speaker Arrangement

MODULE TYPE		SPEAKER	SEAT SPEAKER	SUBWOOFER
M1A2	Driver compartment	4	1	1
	Crew compartment	4	3	1
M1A2 CPH	Driver compartment	4	1	1
	Crew compartment	4	3	1
	Popped hatch	4	0	0

30.1.1.7.7 Sound Quality.

The sound generator shall provide a frequency range of 25 Hertz (Hz) +/- 5 Hz to a minimum of 12,000 Hz. The audio amplifiers shall provide a frequency range of 25 Hz +/- 5 Hz to a minimum of 20,000 Hz. The combined signal to noise ratio of the sound generator and audio amplifiers shall be a minimum of 70 dB. The combination of speaker types shall provide a composite frequency response of 25 Hz to 20,000 Hz +/- 10 dB (after each speaker has been independently referenced to 0 dB).

30.1.1.8 Communication System.

A communication system shall be provided to the M1A2 manned module as described in section 3.7.6 of this specification.

30.1.1.9 Visual Display System.

The visual display system shall meet the requirements stated in Appendix A, Visual System For The Close Combat Tactical Trainer.

30.1.2 Physical Characteristics.

The following paragraphs contain the detailed physical requirements for the individual crew stations within each M1A2 simulator system. The M1A2 crew compartment shall exist as two separate enclosures: an enclosure for the driver's station, and an enclosure for the tank commander, the gunner, and the loader stations. Each of these stations shall include seats replicating those respective seats (including full range of motion and adjustments) found in the operational M1A2 tanks as well as the controls, indicators and other pieces of equipment. The module enclosure base shall provide support for all module components and shall incorporate forklift provisions to facilitate handling and transportation. Functional controls, indicators, and other pieces of equipment shall have proper coloring and labels. All items must be located in the same position as the actual vehicle within the tolerance of this specification. The modules shall provide the controls, switches, indicators and space constraints required to meet the training tasks while avoiding negative training. Some of these items shall be fully replicated while others shall be mock-ups to provide the tactile sensations and space constraints of the actual vehicle. The controls and indicators shall replicate in design, performance, and function their real world counter-parts that are found in the operational M1A2. Realistic control loading and physical limits of travel shall be provided for simulated crew member controls, such as pedals, handles, and steering controls.

30.1.2.1 Driver's Station.

The following buttons, controls, gauges, lights, and switches shall be provided at the driver's station in the locations and panels as found in the actual M1A2.

a. The following controls, indicators, and other pieces of equipment shall be simulated (functional):

(1) Service brake when depressed shall control simulated hydraulic operation of brakes in the transmission. The service brake pedal assembly shall simulate the M1A2 tank service brake pedal assembly. The service brake shall only be functional when the engine is running. In the event of an engine shutdown, the service brake shall be non-functional when vehicle speed is below 3 MPH. Maximum deflection of the service brake pedal shall be 15 degrees (+/- 2.25 degrees). Breakaway force shall be 12.5 lbs (+/- 4 lbs) and ending force shall be 54 lbs (+/- 8lbs), both measured 10 inches from the pivot point.

(2) Parking brake assembly shall consist of the Parking brake pedal and the Parking brake release handle.

(a) The Parking brake pedal when depressed shall operate the brakes in the transmission. The parking brake pedal shall simulate the M1A2 tank parking brake pedal. Pressing the parking brake when it is not already engaged and the parking brake release handle is not pulled shall activate the parking brake inhibiting movement of the tracks. The parking brake shall take into account the current state of the hydraulic system. Maximum deflection of the parking brake pedal shall be 13 degrees (+/- 5 degrees). Ending force shall be 51 lbs (+/- 8 lbs) measured on the pedal 7.25 inches from the parking brake pivot axis.

(b) The parking brake release handle shall release the parking brake. The parking brake release handle shall simulate the M1A2 tank parking brake release handle. Pulling the release handle shall disengage the parking brake, allowing the tracks to rotate. The parking brake release shall be functional at all times. The force required to disengage the parking brake shall be 53 lbs (+/- 8 lbs). Total travel of the parking brake release shall be 5.75 in (+/- 0.9 in). The parking brake shall disengage at 5.5 in (+/-0.8 inch).

(3) Steering/Throttle control assembly shall consist of the steering control, the throttle control, the transmission shift control, intercom buttons and adjustment knob.

(a) The steering control shall be physically and functionally replicated. Deflection of the steering control from center position shall cause the vehicle to turn. Clockwise deflection shall cause the vehicle to turn to the right. Counterclockwise deflection shall cause the vehicle to turn to the left. The steering control shall only be functional when the engine is running and the loss of steering malfunction is not active. In the event of an engine shutdown or activation of the loss of engine power malfunction while the vehicle is moving, the steering control shall be non-functional when vehicle speed is below 3 MPH. Steering control deadband shall be 14 degrees +/- 3 degrees. Breakaway force of the steering mechanism shall be 17 lbs (+/- 3 lbs) applied 7.5 inches from the centerline of the steering assembly. Ending force shall be 35 lbs (+/- 7 lbs) applied 7.5 inches from the steering assembly pivot axis. Specified breakaway and ending forces shall apply to deflection in either direction.

(b) The throttle control shall have a deadband of 2.5 degrees +/- 1.5 degrees. Maximum deflection shall be 62 degrees (+/- 9.3 degrees). Breakaway torque of the throttle control shall be 4 in-lbs (+/- 2 in-lbs). Ending torque shall be 10 in-lbs (+/- 5 in-lbs). Deflection of the throttle control from the full forward position shall cause additional fuel flow in the engine dynamics model. The throttle control shall only be functional when the engine is running and the loss of engine power malfunction is not active.

(c) The transmission shift control shall provide 5 gear selections: neutral(N), pivot(PVT), reverse®, drive(D) and low(L). Transmission selections shall modify the action of the engine output. The transmission control shall only be functional when the engine is running.

(d) The Left and Right intercom press to talk buttons shall enable the driver to talk over the communications subsystem without removing his hands from the steering/throttle control.

(e) The steering/throttle control adjustment knob shall be functional and shall provide the capability to adjust steering/throttle assembly's position.

(4) Driver's Integrated Display (DID) panel shall be functionally and physically replicated. The display shall depict: warning and caution indications as they occur, menus, fuel level indicator, electrical system charge, vehicle speed, steer-to indicator, vehicle heading indicator and engine RPM. The following switches and indicators on the Driver's Integrated Display panel shall be physically replicated and function as described:

(a) MAIN MENU button - This button shall return the DID to its main menu.

(b) Menu Option/Select buttons - These shall perform the selected operation for that particular menu and system mode.

(c) MASTER POWER button - This button shall turn vehicle master power on and off.

(d) PANEL LIGHTS button - This button shall enter or exit DID PANEL LIGHTS mode. While in PANEL LIGHTS mode, the brightness of the DID display shall be adjustable using the 4-way switch.

(e) PUSH TO START button - This button shall initiate an engine start up sequence to begin if vehicle master power is on, there is fuel in the rear fuel tank, and the engine is not already running.

(f) STARTER ONLY button - This button, when vehicle master power is on and the engine is not running, shall activate the starter motor and its aural cue.

(g) DECU RESET button - This button shall reset the DECU error list.

(h) SHUT OFF button - This button shall initiate a five minute engine cooldown process if pressed once, or an immediate engine shutdown sequence if pressed twice.

(i) TACTICAL IDLE switch - This switch, when in the ON position, shall cause the engine idle speed to increase from 900 RPM (+/- 30 RPM) to 1300 (+/- 50 RPM).

(j) 4-way, center position off switch - This switch shall move the cursor and scroll through selections on the DID display, or adjust the brightness of the display while in PANEL LIGHTS mode.

(k) FIRE EXTINGUISHER 2ND SHOT switch - This switch shall be a 2-position toggle switch with red guard/cover. Setting this 2-position toggle switch to the ON position shall cause the engine to be shutdown and the engine shutdown sequence aural cue to be activated. Any existing fire shall be extinguished.

(l) DID displays shall replicate the Pre/Post and Combat mode displays found in the actual M1A2 vehicle operational software, version 2.1.1 (refer to SSDD-00001 Ver 6.0, System / Segment Design Document, M1A2 Main Battle Tank, Vol. 3, Soldier/Machine Interface, 05 February 1993 for further details).

i. The DID displays and associated controls that shall be functional are as follows:

MAIN MENU
- SMOKE GEN OFF ON
- LIGHTS
  - STOP LIGHTS OFF ON
  - SERVICE LIGHTS OFF ON
  - BO MARKERS OFF ON
  - DTV OFF ON
  - AUX SYSTEMS
    - BILGE PUMP OFF ON
  - FUEL XFER
    - LEFT TANK OFF ON
    - RIGHT TANK OFF ON
    - HEATER
      - HEATER OFF ON
      - HEATER TEMP LOW HIGH
      - FAN OFF ON
  - SPEED MPH/KPH
  - DTV OFF ON
- MAINT/BACKUP
  - STATUS
    - CAUTION/WARNING
  - HULL CB
  - CID BACKUP
    - POS/NAV

MANUAL POSN UPDATE
AUTO HEADING INIT
TURRET CB
WAYPOINT
COMPASS OFF ON
CID OFF ON

ii. The DID displays and associated controls that shall not be functional are as follows:

POWER SOURCES
BATTERY START 4 6
HI BEAM OFF ON
NBC CONTROLS
NBC MAIN OFF ON
NBC BACKUP OFF ON
NBC TEMP ADJUST
NBC ALARM MUTE
ENGINE HOURS
ENGINE TRIM/CAL
DIAG

(5) Driver's Night Vision Viewer (NVV) shall be simulated version of the AN/VVS-2 NVV and shall interface to the visual system. Installing the simulated NVV shall cause the visual system to display a graphical night vision replication of the surrounding terrain which shall be presented whenever simulated power is available to the viewer. The driver shall be able to install and remove the driver's night viewer.

(a) Off-Bright Knob - shall be an active control which shall simulate the removal of power from the NVV when in the OFF position (rotated fully counter-clockwise), and shall increase the level of brightness of Driver's Night Vision Viewer when potentiometer is rotated clockwise.

(b) Power jack - shall be a connector which allows connection of the Driver's Night Vision Viewer to vehicle power. The status of this connection shall be used to determine whether display of night vision or normal vision terrain is to be simulated.

(c) NVV stowage - A trainer unique stowage location shall be provided in the driver compartment.

(d) NVV Rotate - shall be a trainer unique active control that shall simulate slewing the NVV imagery +/- 45 degrees in azimuth.

(6) Intercom/Radio Box - This component shall be functionally replicated. The following switches and indicators on the Intercom/Radio box shall be replicated and function as described:

(a) Monitor switch - This switch shall be a 5-position switch. Active switch positions shall be labeled “ALL”, “A”, “INT ONLY”, “B” and “C”.

(b) Volume control - This switch shall control the sound volume.

(c) Left connector (J803) shall allow for connection of an actual CVC helmet. The left connector shall also also be used to detect the rear (intercom) CVC helmet switch position.

(d) Right connector (J802) shall allow for connection of an actual CVC helmet. The right connector shall also be used to detect forward (radio) CVC helmetswitch position and interface to the CVC helmet microphone and earphones (for both simulated intercom and radio).

(e) Remote cable - This cable shall be a fixed dummy cable representing the interconnect of the driver’s intercom switches on the Steering/Throttle control (T-Bar) to the Intercom Control Box.

(7) Domelight assembly - shall be functionally replicated as described:

(a) Domelight lamp - The domelight lamp shall be a bright light capable of illuminating driver’s position.

(b) On/Off brightness control shall be a potentiometer with a switch and shall control the level of brightness of the domelight lamp. Turning knob clockwise shall turn domelight on. Turning knob counterclockwise shall dim light. Turning knob all the way counterclockwise shall turn domelight off.

(8) Deleted

(9) Deleted

(10) Hatch Opening Crank - This shall be provided as a space constraint (except for the handcrank).

(11) Deleted

(12) Driver’s Seat - This seat shall be functionally replicated. The seat shall have a full range of motion and adjustments except for the ability to move the seat into the open hatch position. The seat shall function as follows:

(a) Seat Height Control Lever - This shall allow for adjustment of seat height,

(b) Upper Seat Back Lever - This shall allow for adjustment of upper seat back,

(c) Deleted

(d) Seat manual control lever shall not be functional.

(e) The seat shall have the capability of simulating vehicle vibrations via an embedded speaker or transducer as specified in J.30.1.1.7.6.

(13) Driver's Headrest - This headrest shall be functionally replicated. The headrest shall have a full range of motion and adjustments. Adjustment controls shall be as follows.

(a) Headrest adjustment knob,

(b) Headrest Spring Latch.

(14) Driver's Vision Blocks - 3 vision blocks (periscopes) shall be provided to the driver which shall display scenes generated by the visual system as specified in Appendix A.

(a) Periscope adjustment knobs - These knobs are located on either side of the driver's periscopes and shall be functionally replicated. When loosened, they allow the mirror on the periscope to be adjusted.

(15) Driver's NBC hookups are as follows:

(a) Mask air duct socket shall be physically and functionally replicated.

(b) Cooling Vest air duct socket shall be physically replicated.

(c) Cooling Vest air duct socket cap shall be physically and functionally replicated.

(16) Driver's Head Tracker - This is a trainer unique item which shall provide feedback indicating where driver's head is located and shall be used for vision block control in the driver's periscopes.

(17) Driver's Condition indicator - shall be a trainer unique 2 lamp assembly. An amber lamp shall be illuminated when the driver is considered to be wounded; a red lamp shall be illuminated when the driver is considered dead.

(18) Driver's Parking Brake System Hydraulic Pressure Gauge - shall be functionally replicated, shall indicate parking brake system hydraulic pressure, and shall have a range of 0 - 2000 psi.

(19) NVV Power Cable - shall be functionally replicated. The cable shall interface with the power receptacle on the simulated NVV.

(20) NVV Power Cable Stowage receptacle - shall be physically replicated and shall interface with the NVV power cable for stowage.

30.1.2.2 Turret Compartment.

30.1.2.2.1 Tank Commander's Station.

The following buttons, controls, gauges, lights, and switches shall be provided at the commander's station in the locations and panels as found in the actual M1A2.

a. The following controls, indicators, and other pieces of equipment shall be simulated(functional):

(1) Commander's Integrated Display (CID). The CID shall consist of three parts: the CITV display and control panel, the tactical display and control panel, and the CID switch panel.

(a) Commander's Independent Thermal Viewer (CITV) display and control panel. The CITV display, (left portion of the commander's integrated display) shall be simulated. It shall provide the commander with simulated real time video imagery for surveillance and for target servicing when operated in the CITV gun LOS mode. The CITV shall display scenes generated by the visual system as specified in Appendix A. The CITV control panel shall provide the following input controls and status indications via the illuminated pushbuttons with dimmable outputs to the commander:

i. WHOT/BHOT pushbutton - This pushbutton shall permit selection of polarity of how objects are detected by the CITV sensor (either white hot or black hot) and shall illuminate to indicate its operating mode.

ii. BRIGHT/CTRS pushbutton - This pushbutton, in conjunction with the four-way switch, shall be used to adjust the brightness or contrast of the CITV display in 16 definable increments.

iii. ANTI-GLARE pushbutton - This pushbutton shall toggle through the four filters. Filter selection is 1 to 4 and then wraps around back to 1. When this pushbutton is pressed, the filter number shall appear on the CITV for a few seconds then disappear.

iv. CITV POWER pushbutton - This pushbutton shall turn electrical power to the CITV on and off and shall illuminate when ON.

v. AUTO SCAN pushbutton - This pushbutton shall select CITV AUTO SCAN mode. AUTO SCAN mode allows the CITV to scan a preset sector at a preset rate as in the M1A2 tanks without using the commander's handle. The pushbutton shall illuminate when in the AUTO SCAN mode.

vi. SEARCH pushbutton - This pushbutton shall select CITV SEARCH mode. SEARCH mode allows 360 degree movement of the CITV, independent of the GPS and main gun, by the commander using the control handle with the palm switch depressed.

vii. CITV/GPS pushbutton - This pushbutton shall toggle the CITV Line-Of-Sight between GPS and CITV LOS. When the CITV is selected the CITV thermal image video is displayed, and all CITV controls and functions will be available. When the GPS is selected, the commander has the capability to engage targets through the GPS extension. The pushbutton shall illuminate to indicate its operating mode.

viii. GUN LOS pushbutton - This pushbutton shall, when activated, move the CITV to the gun line of sight. If CITV sight mode is selected, the main gun will follow the CITV line of sight. If GPS sight mode is selected, the main gun and CITV will follow the GPS line of sight. The pushbutton shall illuminate to indicate its operating mode.

ix. Four - way switch - This switch shall provide input to various CITV adjustment functions and tactical control and display functions as in the M1A2 tank. It is a four way switch with center off position, moveable in the up, down, left and right directions, with graphic arrows pointing in the 4 directions.

x. SCTR/RATE pushbutton - This pushbutton shall set sector (SCTR) limits and/or scan RATE to be used in AUTO SCAN mode. When SCTR has been selected, the commander can set the right and left limits using the four-way switch once the commander has moved the CITV to these right and left limits via the control handle. When RATE has been selected, the rate of scan of the CITV can be adjusted using the four-way switch when in the AUTO SCAN mode. The pushbutton shall illuminate to indicate its operating mode.

xi. SYM/RTCL pushbutton - This pushbutton shall be used to select the brightness of either the CITV symbols (SYM) or reticle (RTCL). When SYM has been selected, all symbology brightness can be adjusted on the CITV display using the four-way switch. When RTCL has been selected, reticle brightness can be adjusted using the four-way switch. The pushbutton shall illuminate to indicate its operating mode.

xii. SENS/CTRS pushbutton - This pushbutton shall be used to select either CITV sensitivity (SENS) or contrast (CTRS). Pressing the four-way switch up or down will adjust the sensitivity of the CITV video, while pressing the four-way switch left or right will adjust the contrast of the CITV video. The pushbutton shall illuminate to indicate its operating mode.

xiii. FOCUS/DRIFT pushbutton - This pushbutton shall be used to select either the CITV FOCUS or DRIFT. When FOCUS has been selected, use the four-way switch to adjust (focus) CITV scene. When DRIFT has been selected, use the four-way switch to null out drift. The pushbutton shall illuminate to indicate its operating mode.

(b) Tactical display and control panel. The CID tactical display (center portion of the commander's integrated display) shall be simulated. It shall provide the commander with real time tactical data, including warning and caution messages as they occur. The display shall simulate the same operating characteristics as the actual system. The CID tactical control panel shall provide the following input controls and status indications via the illuminated pushbuttons with dimmable outputs to the commander:

i. Menu Option/Select pushbuttons - Allows the commander to initiate functions for the CID.

ii. PANEL LIGHTS pushbutton - This pushbutton switch shall be used to vary the overall brightness of the entire tactical display, using the four-way switch to increase or decrease brightness.

iii. PRE/POST mode pushbutton - This pushbutton shall be used to access the Pre/Post combat mode menu structure. The light on the switch shall illuminate when the mode transition is complete.

iv. Combat mode pushbutton - This pushbutton shall be used to access the Combat mode menu structure. The light on the switch shall illuminate when mode transition is complete. During vehicle power up the system will default to Combat mode.

v. DIAG mode pushbutton - This pushbutton switch is used to access the diagnostic mode menu structure. This switch shall be physically replicated and shall function as needed for simulated vehicle maintenance procedures.

vi. CID tactical displays shall replicate the Pre/Post mode displays found in the actual M1A2 vehicle operational software, version 2.1.1 (refer to SSDD-00001 Ver 6.0, System / Segment Design Document, M1A2 Main Battle Tank, Vol. 3, Soldier/Machine Interface, 05 February 1993 for further details).

1. The CID tactical Pre/Post displays and associated controls that shall be functional are as follows:

   PASSWORD
   PRE/POST MAIN MENU
     MAP TOOLS
       SCROLL OFF ON
       SCROLL HOME
       ZOOM
     IVIS
       USER ID
       ZEROIZE ALL
       FILE MGT
       RIU SIL OFF ON
       IVIS HELP
     MISSION PLANNING
       DISPLAY OVERLAY
       EDIT OVERLAY
       DELETE OVERLAY
       SEND OVERLAY
       NAVIGATE
         MAP TOOLS
         STEER TO WAYPOINT
     AUX SYSTEMS
       CITV SETUP
       POS/NAV SETUP
       CLOCK
       AUX PUMP OFF ON
     STATUS
       CAUTION WARNING
     TURRET CB (shall function as needed for simulated vehicle maintenance procedures)

2. The CID tactical Pre/Post displays and associated controls that shall not be functional are as follows:

   AUTO OFF ON
   AUX CONTROLS
       LDR DTV OFF ON
       TUR UTIL OFF ON
       CITV PLUMB/SYNC (CITV SETUP)

vii. CID tactical displays shall replicate the Combat mode displays found in the actual M1A2 vehicle operational software, version 2.1.1 (refer to SSDD-00001 Ver 6.0, System / Segment Design Document, M1A2 Main

Battle Tank, Vol. 3, Soldier/Machine Interface, 05 February 1993 for further details).

1. The CID tactical Combat displays and associated controls that shall be functional are as follows:

PASSWORD
COMBAT MAIN MENU
  MAP TOOLS
  COMMO
    RADIO A
      SQUELCH OFF ON
      ZEROIZE RADIO A
      SAVE
      SINCGARS HELP
    RADIO B
      SQUELCH OFF ON
      ZEROIZE RADIO B
      SAVE
      SINCGARS HELP
    EDIT TABLE
      DELETE NODE
      EXIT NETWORK
  MISSION PLANNING (Same as Pre/Post Combat Mode)
  REPORTS
    CONTACT REPORT
      MAP TOOLS
      SEND
      CALL FOR FIRE
        MAP TOOLS
        IMMED SMOKE
        IMMED SUPPR
        FIRE FOR EFFECT
    SPOT REPORT
      MAP TOOLS
      SEND
      CALL FOR FIRE
        MAP TOOLS
        IMMED SMOKE
          IMMED SUPPR
        FIRE FOR EFFECT
      ACTIVITY
        ATTACK
        DEFEND
        RECON

WITHDRAW
FRIENDLY ACTION
CONTINUE
OBSERVE
CALL FOR FIRE
MAP TOOLS
IMMED SMOKE
MAP TOOLS
SEND
IMMED SUPPR
MAP TOOLS
SEND
FIRE FOR EFFECT

2. The CID tactical Combat displays and associated controls that shall not be functional are as follows:

MEDIVAC REQUEST
MAP TOOLS
SEND
PICKUP GRND AIR
AIR OFF ON (Including ammo type selection)
LIGHTS
BLACKOUT OFF ON
STOP OFF ON
SERVICE OFF ON
HI BEAM OFF ON
DTV OFF ON
POWER SOURCES
BAT STRT 4 6
FUEL TRANSFER
L TANK OFF ON
R TANK OFF ON
SMK GEN OFF ON

(c) The CID switch panel (right portion of the commander's integrated display) shall be simulated and shall provide the following input controls and status indications via the illuminated pushbuttons to the commander:

i. Keypad - The keypad shall be physically and functionally replicated. It shall be a dedicated 16-key keypad to permit entry of alphanumeric data required for various menu functions within the CID. It is a 4x4 keypad with the following labels (listed in top to bottom, left to right order) on it: "ABC 1", "DEF 2", "GHI 3", "CLR", "JKL 4", "MNO 5", "PQR 6", "LTR", "STU 7", "VWX 8", "YZ 9", "->" , "." , "0" , "-" , "ENT" .

ii. MASTER POWER pushbutton - This pushbutton shall turn vehicle electrical power on and off and shall illuminate when master power is ON.

iii. TURRET POWER pushbutton - This pushbutton shall turn turret power on and off and shall illuminate when turret power is ON. If master power is on and turret power is transitioned from on to off or off to on then the LED shall blink while turret power is transitioning. If both turret and master power are off, then the turret power switch shall turn on both master and turret power.

iv. BATTLE SIGHT pushbutton - This pushbutton shall be used to manually update target range for selected ammunition. When pressed, battle sight causes the preset battle range for the current ammo set by the gunner to be displayed and can be updated using the four-way switch.

v. NBC MAIN pushbutton - This pushbutton controls the on/off functions of the main NBC system and shall only function to operate the NBC MAIN blower. The blower used by the NBC mode main shall be the same blower that is used by the NBC backup mode.

vi. NBC BACKUP pushbutton - This pushbutton controls the on/off function of the backup NBC system and shall only function to operate the NBC BACKUP blower. The blower used by the NBC mode backup shall be the same blower that is used by the NBC main mode.

vii. ALARM MUTE pushbutton - This pushbutton turns the NBC warning alarm off and shall be physically and functionally replicated.

viii. TEMP pushbutton - This pushbutton controls the filtered air temperature and shall be physically and functionally replicated with the exception of modifying the actual air temperature.

ix. READY pushbutton - This pushbutton shall arm the smoke grenade launchers. It must be pressed and held to fire the smoke grenades. Releasing the switch disarms the grenade launchers.

x. Smoke grenade SALVO 1 pushbutton - This pushbutton shall simulate firing the first salvo of six smoke grenades, three from each side, if the launchers are armed.

xi. Smoke grenade SALVO 2 pushbutton - The pushbutton shall simulate firing the second salvo of six smoke grenades, three from each side, if the launchers are armed.

(2) Commander's control handle assembly (CCHA) shall be functionally replicated. The CCHA shall control main gun elevation and turret traverse during powered operation. When operated in conjunction with either the AUTO SCAN or SEARCH switches located on the CITV switch panel, the commander's handle shall control the CITV movement and functions. It shall control the turret and main gun/coax to include ranging and firing when operated with either the CITV GUN LOS or GPS mode. Handle movement and functionality of all switches shall simulate those of the M1A2 tank. Directional movement of the handle (left,right,forward, and back) and the six switches shall be functionally simulated. The handle and switches shall return to normal (de-energized) position when the force on them is removed.

(a) Commander's control handle assembly traverse throw shall be 91 +/- 8 degrees in both directions. Elevation throw shall be 28 +/- 8 degrees. Depression throw shall be 30 +/- 8 degrees. CCHA neutral position shall be within 2 degrees of mechanical center. Turret azimuth and elevation movement as a function of handle deflection shall reflect that of the M1A2 tank.

i. Elevation rate versus handle deflection shall be as follows:

1. An elevation rate of 0.0 +/- 0.0 mils/second for a deflection of 0.0 degrees.

2. An elevation rate of 0.0 +/- 1.0 mils/second for a deflection of 2.8 degrees.

3. 3. An elevation rate of 24.3 +/- 2.4 mils/second for a deflection of 19.6 degrees.

4. An elevation rate of 44.5 +/- 4.5 mils/second for a deflection of 21.2 degrees.

5. An elevation rate of 450.0 +/- 45.0 mils/second for a deflection of 30.0 degrees.

6. The elevation rate plotted as a function of handle deflection shall be linear (constant slope) between the breakpoints specified above. The tolerance for elevation rates between the breakpoints specified above is +/- 10% of the expected elevation rate.

ii. Traverse rate versus handle deflection shall be as follows:

1. A traverse rate of 0.0 +/- 0.0 mils/second for a deflection of 0.0 degrees.

2. A traverse rate of 0.0 +/- 1.0 mils/second for a deflection of 1.7 degrees.

3. A traverse rate of 20.4 +/- 2.0 mils/second for a deflection of 30.0 degrees.

4. A traverse rate of 48.2 +/- 3.5 mils/second for a deflection of 34.5 degrees.

5. A traverse rate of 750.0 +/- 75.0 mils/second for a deflection of 90.0 degrees.

6. The traverse rate plotted as a function of handle deflection shall be linear (constant slope) between the breakpoints specified above. The tolerance for traverse rates between the breakpoints specified above is +/- 10% of the expected traverse rate.

(b) Commander's control handle assembly controls are as follows:

i. Palm switch shall be a pushbutton switch and shall remove control of turret from gunner's handles and shall give control to the commander when in Gun LOS mode. If in non-Gun LOS mode (SEARCH or AUTO SCAN) then this switch shall enable control of the CITV sensor LOS. Squeezing the palm switch enables the operation of the following switches/buttons on the commander's handle: Target Designate, Trigger, and Range. Squeezing the palm switch shall control the gun when in the Gun LOS mode and the CITV when in a non-Gun LOS mode.

ii. Stadia Range / Lase button is a pushbutton switch that shall control the laser rangefinder if in GUN LOS mode, or shall control the display of the stadia ranging reticle if in SEARCH or AUTO SCAN mode.

iii. Trigger switch shall be a pushbutton switch and shall fire the main gun or coaxial machinegun.

iv. Field of View button shall be a pushbutton and shall be used to toggle the CITV field of view between wide FOV and narrow FOV.

v. Target Designate pushbutton shall align the main gun and coax machinegun with the CITV reticle, when the CITV is in AUTO SCAN or SEARCH mode.

vi. Cursor controller shall be an omni-directional depressible switch and shall be used for tactical display cursor operations.

vii. Left/right deflection sensor shall control turret azimuth movement.

viii. Elevation/depression deflection sensor shall control gun elevation movement.

(3) Domelight shall function as described:

(a) Domelight lamp shall be a bright light capable of illuminating commander's position.

(b) On/off brightness control shall be a potentiometer with a switch and shall control the level of brightness of the domelight lamp. Turning knob clockwise shall turn domelight on. Turning knob counterclockwise shall dim light. Turning knob all the way counterclockwise shall turn domelight off.

(4) Intercom/radio box shall be functionally replicated. The following switches/connectors/controls shall be replicated and function as described:

(a) Monitor switch - This switch shall be a 5-position switch. Active switch positions shall be labeled "ALL", "A", "INT ONLY", "B" and "C".

(b) VOLUME control shall control the sound volume.

(c) Left connector (J803) shall allow for connection of an actual CVC helmet. The left connector shall also be used to detect the rear (intercom) CVC helmet switch position.

(d) Right connector (J802) shall allow for connection of an actual CVC helmet. The right connector shall also be used to detect forward (radio) CVC helmet switch position and interface to the CVC helmet microphone and earphones (for both simulated intercom and radio).

(5) Commander's GPS extension shall display scenes generated by the visual system as specified in Appendix A. The GPS shall show tank commander the target, gun sighting view and data.

(a) Diopter adjustment shall allow for simulated focusing of the GPS extension eyepiece on reticle pattern.

(b) A sensor shall be provided to determine when the sight is in use and when activated, the GPS Extension sight shall display simulated GPS imagery. Browpad shall have an adjusting screw.

(6) Improved Commander's Weapon Station (ICWS) shall be simulated as follows:

(a) The 0.50 caliber machine gun shall be simulated functionally but not physically.

(b) The 0.50 caliber machine gun ammo supply, load and unload functions are as follows:

i. ROUNDS IN STORAGE - shall be a trainer unique panel used to monitor the storage and control the removal of ammo cans from the 0.50 caliber ammo storage area. The following components shall be provided:

1. ROUNDS IN STORAGE shall be a 4 digit display that indicates the simulated number of ammo cans in the ammo storage area.

2. FILL WEAPON AMMUNITION BOX shall be a pushbutton switch that initiates the simulated transfer of a can from the storage area to the 0.50 caliber machine gun ammunition box.

ii. ROUNDS IN AMMUNITION BOX - shall be a trainer unique panel indicating the number of rounds in the ammunition box.

iii. MACHINE GUN - shall be a trainer unique panel used to control and monitor the loading and unloading of the 0.50 caliber machine gun. The following components shall be provided:

1. LOAD/UNLOAD shall be a pushbutton switch that when depressed will initiate the loading of the 0.50 caliber machine gun if unloaded or unload the 0.50 caliber machine gun if loaded.

2. LOADED indicator shall be a green indicator that illuminates when the 0.50 caliber machine gun is loaded. The indicator shall flash during the simulated load time.

3. UNLOADED indicator shall be a green indicator that illuminates when the 0.50 caliber machine gun is unloaded. The indicator shall flash during the simulated unload time.

(c) Trainer unique ICWS aiming controls shall allow for the simulated movement of the gun ring and control of the M2 .50 caliber machine gun.

i. A two-axis joystick shall be provided which allows for the movement of a simulated 0.50 caliber machine gun horizontally and vertically within the commander vision blocks.

ii. A fire button shall be provided that allows for the simulated firing of the 0.50 caliber machine gun.

(7) Commander’s seat assembly shall replicate the actual M1A2 commander’s seat including full range of motion and adjustments. The seat shall function as follows:

(a) Footrest bar - shall be capable of being placed in the stowed and non-stowed positions.

(b) Height adjustment knob - shall allow for adjustment of seat height.

(c) The seat shall have the capability of simulating vehicle vibrations via an embedded speaker of transducer as specified in J.30.1.1.7.6.

(8) Commander's lower platform shall be functionally replicated.

(9) Tank Commander's Condition indicator - shall be a trainer unique 2 lamp assembly. An amber lamp shall be illuminated when the commander is considered to be wounded; a red lamp shall be illuminated when the commander is considered dead.

(10) Commander's NBC hookups are as follows:

(a) Mask air duct socket shall be physically and functionally replicated.

(b) Cooling Vest air duct socket shall be physically replicated.

(c) Cooling Vest air duct socket cap shall be physically and functionally replicated.

(11) Commander's head tracker is a trainer unique item which shall provide feedback indicating where commander's head is located and shall be used for vision block control in the commander's cupola.

(12) Commander's arm guard shall be physically and functionally replicated. The following related items will be replicated as follows:

(a) Hook shall be physically and functionally replicated.

(b) Latch shall be physically and functionally replicated.

(13) Commander's knee guard shall be physically and functionally replicated.

(14) Commander's arm rest shall be physically replicated.

(15) Commander's Vision Blocks - 8 vision blocks (periscopes) shall be provided to the commander which shall display scenes generated by the visual system as specified in Appendix A.

(16) Commanders Hatch Assembly (Hatch cover, handle). For the Commander's Popped Hatch (CPH) version the hatch cap, when closed, shall be able to be opened by the handles. A hinging mechanism shall cause the cap to move to an opening of approximately four inches (this spacing shall replicate the actual vehicle). The

popped hatch view shall cover a 360-degree field of view and shall be obstructed by structures replicating the vision block housings, machine gun mounts, hatch hinge mechanisms, and a modified machine gun; when the cap is closed the module vision blocks shall use the same monitors to the same degree as in popped hatch mode.

(a) Hatch Open/Close switch - For the CPH version, this shall be a trainer unique switch used to detect when the hatch is in the opened position or the closed position.

(17) Commander's Curtain Assembly - shall be physically replicated.

30.1.2.2.2 Gunner's Station.

The following buttons, controls, gauges, lights, and switches shall be provided at the gunner's station in the locations and panels as found in the actual M1A2.

a. The following controls, indicators, and other pieces of equipment shall be simulated(functional):

(1) Gunner's Power Control handle assembly (GCHA) shall contain the following operational and functional components. Traverse throw shall be 91 degrees +/- 8 degrees in both directions. Elevation throw shall be 28 degrees +/- 8 degrees in both directions. Depression throw shall be 30 degrees +/- 8 degrees in both directions. Elevation and traverse rates versus handle deflection shall be same as commander's control handle. GCHA neutral position shall be within 2 degrees of mechanical center. The switches shall return to normal (de-energized) position when the force on the switch is removed.

(a) Palm switches shall function as follows:

i. Left palm switch shall be physically and functionally replicated and shall enable the gunner's control handles.

ii. Right palm switch shall be physically and functionally replicated and shall enable the gunner's control handles.

(b) Trigger switches shall function as follows:

i. Left trigger switch shall be a red pushbutton switch. Squeezing this switch with gunner's station powered up and either palm switch depressed shall fire main gun or coaxial machine gun.

ii. Right trigger switch shall be a red pushbutton switch. Squeezing this switch with gunner's station powered up and either palm switch depressed shall fire main gun or coaxial machine gun.

(c) Laser switches shall function as follows:

i. Left laser switch shall be a red pushbutton switch. Pressing this switch with gunner's station powered up and either palm switch depressed shall operate laser rangefinder.

ii. Right laser switch shall be a red pushbutton switch. Pressing this switch with gunner's station powered up and either palm switch depressed shall operate laser rangefinder.

(d) Power elevation and traverse shall be simulated as follows:

i. Rotating gunner's handles backward shall elevate the weapons whereas rotating gunner's handles forward shall depress the weapons.

ii. Rotating gunner's handles clockwise shall traverse turret right whereas rotating gunner's handles counterclockwise shall traverse turret left.

(e) Manual elevation shall be simulated as follows:

i. Cranking the manual elevation handle clockwise shall elevate main gun and coaxial machine gun whereas cranking handle counterclockwise shall lower main gun and machinegun. The manual elevation assembly shall drive the simulated gun at a rate of 10.175 mils +/- 5% per revolution of the handcrank. With main gun pointed to the front of the vehicle, gun depression shall be limited to 10 degrees. Gun elevation shall be limited to 20 degrees for 360 degrees turret travel while operating the manual elevation handle assembly.

ii. Squeezing the manual elevation palm switch shall allow for rotation of manual elevation handle.

iii. Emergency trigger shall be a red pushbutton and shall fire main gun or machinegun in the normal, emergency, or manual mode of operation.

(f) Manual traverse shall be simulated as follows:

i. Cranking the manual traverse handle clockwise shall traverse turret right whereas cranking handle counterclockwise shall traverse turret left. Nominal rates of 5 and 10 mils per crank revolution shall be simulated. One revolution of the hand traverse crank shall rotate the turret 10.561 mils +/- 5% when the 10 mil rate is selected and 5.28 mils +/- 5% when the 5 mil rate is selected. The manual handcrank shall provide 360 degrees of simulated turret traverse rotation.

ii. Squeezing the manual traverse palm switch shall allow for rotation of manual drive handle.

iii. Blasting machine shall be physically and functionally replicated.

(2) Gunner's Primary Sight (GPS) shall contain operational and functional components as follows:

(a) GPS eyepiece shall display scenes generated by the visual system as specified in Appendix A.

i. Diopter ring shall allow for simulated focusing of the reticle in the GPS eyepiece for clearer viewing.

ii. A sensor shall be provided to determine when the sight is in use and when activated, the GPS sight shall display simulated GPS imagery. The browpad shall have an adjusting thumbscrew and shall have left and right holding grooves.

(b) GPS upper panel assembly shall contain operational and functional components as follows:

i. FIRE CONTROL MODE switch shall be a three position magnetically held (EMERGENCY and MANUAL positions) toggle switch. Active switch positions shall be labeled “NORMAL”, “EMERGENCY” and “MANUAL”.

ii. FIRE CONTROL MODE lights shall be simulated as follows:

1. EMERGENCY lamp shall be a amber dome lamp and shall illuminate when FIRE CONTROL MODE switch is set to the EMERGENCY position or PANEL LIGHTS TEST pushbutton is pressed.

2. NORMAL lamp shall be a green dome lamp and shall illuminate when FIRE CONTROL MODE switch is set to the NORMAL position or PANEL LIGHTS TEST pushbutton is pressed.

3. MANUAL lamp shall be a white dome lamp and shall illuminate when FIRE CONTROL MODE switch is set to the MANUAL position or PANEL LIGHTS TEST pushbutton is pressed.

iii. PANEL LIGHTS TEST switch shall be a black pushbutton switch with skirt and shall turn on all GPS and Thermal Imaging System (TIS) indicator lights to full brightness.

iv. PANEL LIGHTS control shall be a potentiometer for lamp dimming and shall control brightness of GPS (upper and lower panels) and TIS indicator lights.

v. Not used

vi. DEFROSTER switch shall be a mechanical control which replicates the appearance and movement of the corresponding actual control. This control shall be physically replicated but non-functional.

vii. DEFROSTER lamp shall be a green dome lamp and shall illuminate only when PANEL LIGHTS TEST pushbutton is pressed.

viii. RETICLE knob shall be a potentiometer and shall control the brightness of the GPS day sight reticle.

ix. Unity window shall display scenes generated by the visual system as specified in Appendix A.

x. GPS ballistic door handles shall be replicated and function as follows:

1. DAY handle shall be a two position handle assembly with “DAY” written on the handle and shall simulate opening the left ballistic door by squeezing finger lever on top and turning clockwise.

2. THERMAL handle shall be a two position handle assembly with “THERMAL” written on the handle and shall simulate opening the right ballistic door by squeezing finger lever on top and turning counterclockwise.

(c) GPS lower panel assembly shall contain operational and functional components as follows:

i. NORMAL MODE DRIFT AZ knob shall correct for turret azimuth drift in stabilized (normal) sighting system. This knob shall have “PUSH TO TURN” written on it in white letters.

ii. NORMAL MODE DRIFT EL knob shall correct for elevation drift in stabilized (normal) sighting system. This knob shall have “PUSH TO TURN” written on the it in white letters.

iii. FLTR/CLEAR/SHTR switch shall be a three position 120 degree rotary switch and shall have a pointer knob with active positions labeled “FLTR”, “CLEAR”, and “SHTR”. This switch shall position clear window or shutter in the GPS day optic system, and shall have no effect in the filter position.

iv. GUN SELECT switch shall be a three position magnetically held (MAIN and COAX positions) toggle switch with active positions labeled “MAIN”, “TRIGGER SAFE” and “COAX”. This switch shall select main gun or coaxial machinegun firing circuit for firing or trigger safe so neither gun will fire. Switch shall reset to safe when power is turned off. If switch is set to COAX with engine running, the NBC MAIN system shall turn on (blower only).

v. GUN SELECT lamps shall be simulated as follows:

1. MAIN lamp shall be a green dome lamp and shall illuminate when GUN SELECT switch is set to MAIN or PANEL LIGHTS TEST pushbutton is pressed.

2. TRIGGER SAFE lamp shall be a white dome lamp and shall illuminate when GUN SELECT switch is in the TRIGGER SAFE position or PANEL LIGHTS TEST pushbutton is pressed.

3. COAX lamp shall be a green dome lamp and shall illuminate when GUN SELECT switch is set to COAX or PANEL LIGHTS TEST pushbutton is pressed.

vi. AMMUNITION SELECT pushbuttons shall be five pushbuttons with back lights. These pushbuttons shall input ammunition type data into the Fire Control Electronics Unit and the Turret Electronics Unit when GUN SELECT switch is set to MAIN.

1. SABOT pushbutton shall have a square green LED on a backlit pushbutton with the label “SABOT” and a partial guard and shall illuminate when pressed, or if PANEL LIGHTS TEST pushbutton is pressed.

2. HEAT pushbutton shall have a square green LED on a backlit pushbutton with the label “HEAT” and a partial guard and shall illuminate when pressed, or if PANEL LIGHTS TEST pushbutton is pressed.

3. MPAT pushbutton shall be physically replicated but non-functional.

4. STAFF pushbutton shall be physically replicated but non-functional.

5. AIR/GROUND pushbutton shall have dual square green LEDs on a backlit pushbutton with the labels “AIR” and “GROUND” and partial guards. The upper LED is to the left of the AIR label and the lower

LED is to the left of the GROUND label. The LEDs shall toggle when pressed, or if PANEL LIGHTS TEST pushbutton is pressed.

vii. MAGNIFICATION switch shall be a two position lever assembly with positions “3X” and “10X” active. This switch shall select optical 3X or 10X magnification for the GPS day optical system.

(d) Laser Rangefinder (LRF) shall contain the following components:

i. RANGE switch shall be a three position toggle switch with active positions labeled “SAFE”, “ARM 1ST RTN”, and “ARM LAST RTN”. This switch shall set first or last return, or safe mode of LRF. The LRF shall return to safe when turret power is turned off, but switch shall not trip to safe position.

ii. Test shall be a dummy connector with cover.

(e) Image Control Unit (ICU) shall contain operational and functional components as follows:

i. CONTRAST shall adjust the contrast of TIS image.

ii. POLARITY shall be a two position toggle switch with active positions labeled “WHITE HOT” and “BLACK HOT”. This switch shall select white or black presentation of hot objects in TIS image.

iii. RETICLE shall be used to adjust reticle intensity from white to black in TIS image.

iv. TRU READY lamp shall be a green dome lamp and shall illuminate when thermal receiver is ready for operation or shall illuminate if PANEL LIGHTS TEST pushbutton is pressed.

v. FAULT lamp shall be a yellow dome lamp and shall illuminate if PANEL LIGHTS TEST pushbutton is pressed.

vi. SYMBOLS shall be used to adjust brightness of range, multiple returns, ready-to-fire symbol, and fire control fault “F” symbol in the GPS field of view. This knob shall be used for both day and TIS operation.

vii. SENSITIVITY shall adjust the brightness of the TIS image.

viii. THERMAL MODE shall be a three position toggle switch with active positions labeled “OFF”, “STBY”, and “ON”. This switch shall select OFF, ON, or STBY mode of TIS.

ix. THERMAL TEST UNIT TEST PATTERN shall be a five position rotary switch with active positions labeled “OFF”, “PCU”, “ICU”, “EU”’ and “TRU”. Each switch position, excluding OFF position, shall bring up a specific test pattern in the GPS.

x. BORESIGHT shall be replicated and function as follows:

1. AZ knob shall be a mechanical control which replicates the appearance and movement of the corresponding actual control. This control shall be physically replicated but non-functional.

2. 2. EL knob shall be a mechanical control which replicates the appearance and movement of the corresponding actual control. This control shall be physically replicated but non-functional.

(f) Thermal Receiving Unit (TRU) shall contain operational and functional components as follows:

i. THERMAL MAGNIFICATION control shall be a two position lever assembly with “3X” and “10X” positions active. This lever shall select 3X or 10X magnification for TIS image.

ii. FOCUS control shall be a mechanical control which replicates the appearance and movement of the corresponding actual control. This control shall be physically replicated but non-functional.

iii. ANTI-GLARE switch shall be a five position rotary switch with active positions labeled “1”, “2”, “3” , “4” and “5” and shall have a pointer knob. Position 1 shall be no filter; filter positions 2, 3, and 4 shall have no effect on thermal image; and position 5 shall be shutter and shall be used when TIS is in standby and off.

(3) Intercom/radio box shall be functionally replicated. The following switches/connectors/controls shall be replicated and function as described:

(a) MONITOR switch shall be a five position rotary switch and shall allow the crew member to select the channel to be used. Active switch positions shall be labeled “ALL”, “A”, “INT ONLY”, “B” and “C”.

(b) VOLUME control shall be one potentiometer which shall control the sound volume.

(c) Left connector (J803) shall allow for connection of an actual CVC helmet. The left connector shall also be used to detect the rear (intercom) CVC helmet switch position.

(d) Right connector (J802) shall allow for connection of an actual CVC helmet. The right connector shall also be used to detect forward (radio) CVC helmet switch position and interface to the CVC helmet microphone and earphones (for both simulated intercom and radio).

(e) Gunner's remote (foot) intercom switch shall enable the gunner to talk over the intercom.

(f) Remote cable - This cable shall be a fixed dummy cable representing the interconnect of the gunner's remote (foot) intercom switch to the Intercom Control Box.

(4) Domelight shall function as described:

(a) Domelight lamp shall be a bright light capable of illuminating gunner's position.

(b) On/off brightness control shall be a potentiometer with a switch which shall be capable of controlling the level of brightness of the domelight lamp. Turning knob clockwise shall turn domelight on. Turning knob counterclockwise shall dim light. Turning knob all the way counterclockwise shall turn domelight off.

(5) Gunner's Auxiliary Sight (GAS) shall contain operational and functional components as follows:

(a) A sensor shall be provided to determine when the sight is in use and when activated the GAS sight shall display simulated GAS imagery. The browpad shall have an adjusting screw and shall have left and right holding grooves.

(b) GAS browpad adjustment knob shall be physically replicated.

(c) Boresight AZ adjustment - shall be a pictorial representation of the actual control. This control shall not be required because the reticles will be in correct alignment.

(d) Boresight EL adjustment - shall be a pictorial representaiton of the actual control. This control shall be physically replicated but non-functional.

(e) RETICLE select switch shall be a two position rotary switch with active positions labeled "APFSDS" and "HEAT" and shall have a pointer knob. This switch shall select between two separate focal plane ballistics reticles (SABOT and HEAT).

(f) Reticle brightness adjust shall adjust the reticle to desired brightness.

(g) FILTER select switch shall be a two position rotary switch with “IN” and “OUT” positions active and shall have a pointer knob. Filter knob shall provide for normal viewing in both the IN (left) and OUT (right) positions.

(h) Eyepiece shall display scenes generated by the visual system as specified in Appendix A.

(i) Focus (diopter) ring adjustment shall allow for simulated focusing of the GAS eyepiece on reticle pattern.

(6) Gunner’s Control Display Panel (GCDP) shall contain operational and functional components as follows:

(a) MAIN MENU display - This menu appears during power up and is used to initiate all functions available to the gunner. The choices are: “COMBAT”, “ADJUST”, “METRL DATA”, “SENSOR”, “MAINT”, “BACKUP”.

(b) Four-way switch - This switch shall be used to adjust panel lights and various input functions throughout the GCDP menu structure. It is a 5 position thumb switch with up, down, left, right and center positions.

(c) Keypad - The 4x4 keypad allows for alpha characters and numeric entries to be made when required for various menu functions within the GCDP. The keys are (listed in top to bottom, left to right order) - “ABC 1” , “DEF 2” , “GHI 3” , “CLR” , “JKL 4” , “MNO 5” , “PQR 6” , “LTR” , “STU 7” , “VWX 8” , “YZ 9” , “->“ , “.” , “0” , “-” , “ENT” .

(d) PANEL LIGHTS pushbutton - This pushbutton provides for brighten/dim adjustment of the panel display. The four-way switch is used for adjustments.

(e) Menu Option/Select Pushbuttons - These pushbuttons allow the gunner to initiate functions for the GCDP.

(f) GCDP displays shall replicate the Pre/Post and Combat mode displays, including warning and caution messages, found in the actual M1A2 vehicle operational software, version 2.1.1 (refer to SSDD-00001 Ver 6.0, System / Segment Design Document, M1A2 Main Battle Tank, Vol. 3, Soldier /

i. The GCDP displays and associated controls that shall be functional are as follows:

MAIN MENU
  COMBAT
    MRS UPDATE
  ADJUST

BORESIGHT
GPS
MRS
CITV
ZERO
BATTLESIGHT
AMMO SUBDES
METRL DATA
AIR TEMP
AMMO TEMP
BARO PRESS
CROSSWIND A M
SENSORS
RANGE
ATTD
PITCH ROLL OFF ON
CANT
LEAD A M
H/T POSN OFF ON
MAINT
STATUS
FC SYSTEM TEST
FIRE CONTROL CB (shall function as needed for simulated vehicle maintenance procedures)
SETUP
DRIFT
BACKUP
CID CB
CID OFF ON

ii. The GCDP displays and associated controls that shall not be functional are as follows:

H/T ZERO
PLUMB/SYNC
BAL SOLN CHECK
AUX PUMP OFF ON
LOADER DTV OFF ON

(7) Gunner’s seat assembly shall replicate the actual M1A2 gunner’s seat and shall include the full range of motion and adjustments. The seat shall function as follows:

(a) Height adjustment lever - shall allow for adjustment of seat height.

(b) Forward/back adjusting lever - shall allow for adjustment in the forward and backward direction.

(c) The seat shall have the capability of simulating vehicle vibrations via an embedded speaker or transducer as specified in J.30.1.1.7.6.

(8) Gunner's NBC hookups are as follows:

(a) Mask air duct socket shall be physically and functionally replicated.

(b) Cooling Vest air duct socket shall be physically replicated.

(c) Cooling Vest air duct socket cap shall be physically and functionally replicated.

(9) Gunner's Condition indicator - shall be a trainer unique 2 lamp assembly. An amber lamp shall be illuminated when the gunner is considered to be wounded; a red lamp shall be illuminated when the gunner is considered dead.

(10) Hydraulic pressure gage shall be a mechanical indicator which replicates the appearance of the corresponding actual indicator. This indicator shall be physically replicated but non-functional.

(11) Deleted.

(12) Gunner's chest rest shall be functionally replicated and shall have a chest rest adjustment knob.

(13) Coaxial machine gun charging cable and handle shall be physically replicated. Activation of the handle shall clear a 7.62mm machine gun misfire.

(14) Spent ammunition box shall be a partial mock-up for a space constraint.

(15) Ammunition Temperature Guage - shall be physically replicated and non-functional.

30.1.2.2.3 Loader's Station.

The following buttons, controls, gauges, lights, and switches shall be provided at the loader's station in the locations and panels as found in the actual M1A2.

a. The following controls, indicators, and other pieces of equipment shall be simulated(functional):

(1) Loader's Panel (LP) shall contain operational and functional components as follows:

(a) MAIN GUN STATUS lights shall be functionally replicated as follows:

i. ARMED light shall be a amber dome lamp and shall illuminate when main gun firing circuit is armed or when PANEL LIGHTS TEST pushbutton on the GPS Panel is pressed.

ii. SAFE light shall be a white dome lamp and shall illuminate when turret power is applied and main gun firing circuit is not armed or when PANEL LIGHTS TEST pushbutton on the GPS Panel is pressed.

(b) TURRET BLOWER switch shall be a two position switch with active positions labeled “ON” and “OFF”. This switch shall provide the loader the ability to control the NBC main system (turn on/off the blower) provided it is not already operating.

(c) GUN/TURRET DRIVE switch shall be a three position lock lever toggle switch with active positions labeled “EL UNCPL”, “POWERED”, and “MANUAL”. This switch shall set gun and turret drive system to powered, manual, or elevation uncoupled mode.

(d) EL UNCPL light shall be a white dome lamp and shall illuminate when GUN/TURRET DRIVE switch is set to EL UNCPL position.

(e) POWERED light shall be a amber dome lamp and shall illuminate when GUN/TURRET DRIVE switch is set to POWERED position. POWERED position shall allow gunner and tank commander to operate fire control system in stabilized mode.

(f) MANUAL light shall be a white dome lamp and shall illuminate when GUN/TURRET DRIVE switch is set to MANUAL.

(2) Knee switch shall be pushbutton activated knee guard switch. Actuation of the knee switch shall cause the ammo door to open (under normal conditions). Release of the knee switch shall cause the door to close. The knee switch shall be capable of being stowed in the up position.

(3) Ready ammunition door shall be functionally and physically replicated. The door shall automatically open and close when the ammunition door knee switch is activated. The weight of the door shall be less than that of the actual M1A2 ready ammunition door for safety reasons. Full door travel from closed to open shall take 1.5 seconds +/- 0.5 seconds and 2.0 seconds +/- 0.5 seconds from open to closed.

(a) Safety switch shall be an edge activated switch. This switch shall be capable of stopping the movement of the ready ammunition door.

(b) Door Closure assurance latch and lock shall be functionally but not physically replicated. The functionality of the lock and latch can be simulated based upon the door position.

(c) Door closing actuator shall be functionally but not physically replicated. The door shall be opened and closed by a trainer unique actuator located behind the door.

(d) Ammo Door Deactivation switch shall be a lever locked toggle switch with active positions labelled "ON" and "OFF" mounted on the ammunition closure assurance latch bracket and shall deactivate ready ammo door operation.

(e) Door closing actuator release pin shall not be replicated.

(f) Door lockshaft shall not be replicated.

(g) Deleted

(4) Intercom/radio box shall be functionally replicated. The following switches/connectors/controls shall be replicated and function as described:

(a) MONITOR switch shall be a five position rotary switch and shall allow the crew member to select the channel to be used. Active switch positions shall be labeled "ALL", "A", "INT ONLY", "B" and "C".

(b) VOLUME control shall be one potentiometer which shall control the sound volume.

(c) Left connector (J803) shall allow for connection of an actual CVC helmet. The left connector shall also be used to detect the rear (intercom) CVC helmet switch position.

(d) Right connector (J802) shall allow for connection of an actual CVC helmet. The right connector shall also be used to detect forward (radio) CVC helmet switch position and interface to the CVC helmet microphone and earphones (for both simulated intercom and radio).

(5) Domelight shall function as described:

(a) Domelight lamp shall be a bright light capable of illuminating loader's position.

(b) On/off brightness control shall be a potentiometer with a switch which shall be capable of controlling the level of brightness of the domelight lamp. Turning knob clockwise shall turn domelight on. Turning knob counterclockwise shall dim light. Turning knob all the way counterclockwise shall turn domelight off.

(6) Loader’s periscope shall rotate through 360 degrees in either direction and shall display scenes generated by the visual system as specified in Appendix A.

(a) Periscope adjustment knobs - These knobs are located on either side of the loader’s periscopes and shall be functionally replicated. When loosened, they allow the mirror on the periscope to be adjusted.

(b) Vertical Field-Of-View (FOV) Switch - shall be a three position switch which controls the pitch of Loader’s periscope FOV. The three positions shall move the Loader’s vertical FOV up and down between -4.5 degrees and +4.5 degrees. The three positions shall place the Loader’s vertical FOV at +4.5 degrees, 0 degrees, and -4.5 degrees.

(7) Deleted

(8) Audio frequency amplifier (AM 1780/VRC) shall be functionally replicated as follows:

(a) MAIN PWR switch shall be a three position rotary switch with pointer knob and shall have active positions labeled “NORM”, “INT ONLY” and “OFF”. No radio transmission shall be possible when MAIN PWR switch is in INT ONLY position. The entire communications system shall be turned off when MAIN PWR switch is in OFF position.

(b) INT ACCENT switch shall be two position rotary switch with pointer knob and active positions labeled “ON” and “OFF”. Intercom and radio sound levels shall be equal when INT ACCENT switch is set to OFF. Radio sound level shall be lower than intercom when INT ACCENT switch is set to ON.

(c) RADIO TRANS switch shall be a three position rotary switch with pointer knob and active positions labeled “CDR + CREW”, “CDR ONLY”, and “LISTENING SILENCE”. Entire crew shall be able to transmit on radio with RADIO TRANS switch in CDR + CREW position. Only tank commander shall be able to transmit on radio with RADIO TRANS switch in CDR ONLY position. No radio transmission shall be possible with RADIO TRANS switch in LISTENING SILENCE position.

(d) POWER CKT BKR switch shall be a two position trippable toggle type circuit breaker with active positions labelled “ON” and “OFF”.

(e) POWER light shall be a green lamp and shall indicate when power is applied to the communications system.

(f) INSTALLATION switch shall be a three position rotary switch requiring flat blade screwdriver to change switch setting and shall have active positions labeled “INT ONLY”, “OTHER”, and “RETRANS”.

(g) AUDIO INPUT jacks shall be functionally replicated as follows:

i. Left jack shall be non-operational and non-functional.

ii. Right jack shall be non-operational and non-functional.

(h) LINE jacks shall be functionally replicated as follows:

i. Left jack shall be non-operational and non-functional.

ii. Right jack shall be non-operational and non-functional.

(i) Amplifier cover shall be physically and functionally replicated.

(9) Two SINCGARS radios (RT-1523A) shall be functionally and physically replicated. The SINCGARS radios shall be compatible with organizational requirements except as indicated in 3.7.6 for vehicle and headquarters radio configurations and shall allow for communication with the Operations Center (OC) and other desired units. It shall simulate the following controls:

(a) ANT connector shall be a dummy 3-D connector which shall have a dummy cable. On the long range (lower) radio the dummy cable shall connect to the RF power amplifier. On the short range (upper) radio the dummy cable shall connect to the chassis (representing connecting to vehicle antenna).

(b) CHAN (channel) switch shall select manual, preset and cue channels. This switch shall be an 8 - position rotary switch with pointer knob which utilizes the following positions:

i. CUE - This position shall allow the operator to preset SC frequency for the CUE channel or select the preset CUE frequency.

ii. MAN - This position shall allow the operator to preset SC frequency for the MAN channel or select the preset MAN frequency.

iii. 1 - This position shall allow the operator to preset a SC frequency for channel 1. This position shall also select the preset SC frequency when in SC mode and the FH hopset when in FH mode for channel 1. The loading of preset FH channels or COMSEC keys shall be simulated using the external interface unit.

iv. 2 - This position shall allow the operator to preset a SC frequency for channel 2. This position shall also select the preset SC frequency when in SC mode and the FH hopset when in FH mode for channel 2. The loading of preset FH channels or COMSEC keys shall be simulated using the external interface unit.

v. 3 - This position shall allow the operator to preset a SC frequency for channel 3. This position shall also select the preset SC frequency when in SC mode and the FH hopset when in FH mode for channel 3. The loading of preset FH channels or COMSEC keys shall be simulated using the external interface unit.

vi. 4 - This position shall allow the operator to preset a SC frequency for channel 4. This position shall also select the preset SC frequency when in SC mode and the FH hopset when in FH mode for channel 4. The loading of preset FH channels or COMSEC keys shall be simulated using the external interface unit.

vii. 5 - This position shall allow the operator to preset a SC frequency for channel 5. This position shall also select the preset SC frequency when in SC mode and the FH hopset when in FH mode for channel 5. The loading of preset FH channels or COMSEC keys shall be simulated using the external interface unit.

viii. 6 - This position shall allow the operator to preset a SC frequency for channel 6. This position shall also select the preset SC frequency when in SC mode and the FH hopset when in FH mode for channel 6. The loading of preset FH channels or COMSEC keys shall be simulated using the external interface unit.

(c) RF PWR switch shall be a 4 position rotary switch with pointer knob, with the following positions:

i. LO - This position shall set the transmission power to low.

ii. M - This position shall set the transmission power to medium.

iii. HI - This position shall set the transmission power to high.

iv. PA - This position shall set the operation of transmissions for use with the power amplifier, or high power if power amplifier is not connected to the RT.

(d) MODE Switch - This switch shall be a 3 - position rotary switch with pointer knob, with the following positions:

i. SC - This position shall set the Receiver/Transmitter to SC (single channel) mode.

ii. FH - This position shall set the Receiver/Transmitter to FH (frequency hopping) mode.

iii. FH-M - This position shall set the Receiver/Transmitter to FH-M(frequency hopping master) mode. The operator shall be required to pull the switch to go into the FH-M position.

(e) RXMT connector shall be a dummy 3-D connector with a dummy cable connected to the RXMT on the other RT in the radio mount.

(f) FCTN(function) Switch - This switch shall be a 9 - position rotary switch with pointer knob, with the following positions:

i. STBY - This position shall turn off receiver/transmitter (RT) while maintaining memory. The operator shall be required to pull the switch knob in order to go to the STBY position.

ii. TST - This position shall cause the normal self test indications to be displayed on the keyboard display.

iii. LD - This position shall allow the operator to load SC frequencies, and shall also allow the operator to receive ERF data from an RT operating in FH-M mode.

iv. SQ ON - This position shall turn on the RT and activate the squelch.

v. SQ OFF - This position shall turn on the RT and deactivate the squelch.

vi. RXMT - This position shall be non-functional.

vii. REM - This position shall disable the RT's front panel controls.

viii. Z-FH - This position shall clear the RT of all FH data. The operator shall be required to pull the switch knob in order to go to the Z-FH position.

ix. OFF - This position shall turn off all power to the RT. This function shall also erase the RT's memory. The operator shall be required to pull the switch knob in order to go to the OFF position.

(g) DIM Control - This shall be an active control which replicates the appearance and function of the corresponding actual knob.

(h) Keyboard Display shall display all information concerning the operation of the RT including SC frequencies, FH data, error messages, data rates as well as keyboard entries. The display shall consist of 8 full 5 X 7 dot matrix characters that are alphanumeric with the capability to display special characters. The seventh 5 X 7 dot matrix character shall be capable of displaying no dots on column number one, on column number two only displaying dots on rows one, three, five, and seven that have the capability to be lighted individually, no dots on column number three, and capable of lighting all the dots on columns four and five at the same time. The eight dot matrix character shall also be capable of displaying dots arranged in the form of a diamond. All displays shall be dimmable. Color of display shall be green.

(i) Keypad shall be responsible for the entering data into the RT. The keypad shall consist of the following 16 pushbutton keys:

i. CMSC 1 - Shall display the COMSEC key identifier number on the display and enter the number ’1’ into the system.

ii. * 2 - Shall enter the number ’2’ into the system. The special feature activated by this key on the actual RT shall not be selectable or simulated.

iii. SYNC 3 - Shall place the RT into ’late entry’ status allowing the RT to re-enter the network. Also shall enter the number ’3’ into the system.

iv. FREQ - Shall allow the operator to load and clear SC frequencies in the RT.

v. DATA 4 - Shall display the RT’s operational data rate and enter the number ’4’ into the system.

vi. 5 - Shall enter the number ’5’ into the system.

vii. 6 - Shall enter the number ’6’ into the system.

viii. ERF OFST - Shall transmit ERF data to net members when RT is operating in FH-M mode. Also shall load/check SC offset frequencies.

ix. CHG 7 - Shall change current information on display to another available selection. Shall also enter the number ’7’ into the system.

x. 8 - Shall enter the number ’8’ into the system.

xi. LOUT 9 - Shall enter the number ’9’ into the system. Shall also retrieve frequency lockout sets from permanent memory if the RT is operating as Frequency Hop Master.

xii. TIME - Shall be used to check RT FH sync time clock.

xiii. CLR - Shall clear data from display if error was made during entry. Shall also clear data from RT memory.

xiv. LOAD 0 - Shall load data into holding memory in RT and to retrieve data from permanent memory into holding memory. Shall also enter the number ’0’ into the system.

xv. STO - Shall transfer data from RT holding memory onto permanent memory.

xvi. BATT CALL - Shall be non-functional.

(j) COMSEC switch shall be responsible for controlling the communication security modes of the RT. It shall be a 5 - position rotary switch with pointer knob, with the following positions:

i. PT - This position shall place the RT into plain text mode. The operator shall be required to pull the knob in order to place the knob into this position.

ii. CT - This position shall place the RT into cipher text mode.

iii. TD - This position shall be non-functional.

iv. RV - This position shall prepare the RT to receive a remote fill of COMSEC variables from the NCS.

v. Z - This position shall clear COMSEC keys. The operator shall be required to pull the knob in order to place the knob into this position.

(k) VOL/WHSP control shall be a rotational knob used for audio volume control. The knob shall also provide a pullout position which shall be non-functional.

(l) HUB Connector - Dummy cover that shall not be removable.

(m) AUD/FILL connector shall be a dummy 3-D connector.

(n) AUD/DATA connector shall be a dummy 3-D connector. A dummy 3-D cable shall connect to the AUD/DATA connector and the DATA A or DATA B connector of the mounting adapter.

(10) SINCGARS Radios shall be mounted in a short/long range radio configuration. This mounting shall replicate the AN/VRC-89A configuration which contains the following:

a. Amplifier-Adapter, Vehicular (mounting adapter) AM-7239B/VRC.
b. Amplifier, Radio Frequency AM-7238A/VRC.
c. Receiver-Transmitter, Radio RT-1523A.
d. Receiver-Transmitter, Radio RT-1523A.
e. Loudspeaker Control Unit, LS-671/U.

The Configuration shall be replicated as follows:

(a) The mounting adapter shall have two(2) SINCGARS receiver-transmitters as described above. The mounting adapter shall have a simulated Radio Frequency Amplifier connected, and shall also have the following components:

i. CB1 (power) switch shall be a two position trippable toggle switch with an ON and OFF position.

ii. Indicator lamp and lens shall be a green dimmable indicator. The indicator shall flash for 3 +/- 1 second after CB1 switch is moved to ON position, then stay lit. The lens shall allow the indicator to be dimmed by turning clockwise.

iii. The (AUD/DATA B J2) connector shall be a 3-D dummy connector.

iv. The (AUD/DATA A J3) connector shall be a 3-D dummy connector.

v. The (DATA B J4) connector shall be a dummy 3-D connector with a dummy cable connected to the AUD/DATA connector on the top radio.

vi. The (DATA A J5) connector shall be a dummy 3-D connector with a dummy cable connected to the AUD/DATA connector on the top radio.

vii. The (SPKR J6) connector shall be a 3-D dummy connector.

(b) The Radio Frequency Amplifier shall be connected to the mounting adapter. The Radio Frequency Amplifier shall have the following components.

i. The (J1) connector shall be a dummy connector. A dummy cable which represents the connection to a vehicle antenna shall be connected to the J1 connector.

ii. The (J2) connector shall be a dummy connector. A dummy cable which also connects to the ANT connector of the RT mounted in the bottom position of the mounting adapter shall be connected to the J2 connector.

(11) MAIN GUN LOAD/UNLOAD switch shall be a trainer unique switch. When depressed, this switch shall initiate the virtual task of loading the main gun when unloaded and unloading the main gun when loaded.

(12) BREECH OPEN/CLOSE switch shall be a trainer unique, three position, spring-loaded to center switch. Activating the switch to the upper position shall initiate the virtual task of opening the main gun breech and activating the switch to the lower position shall initiate the virtual task of closing the breech.

(13) MAIN GUN STATUS - shall be a trainer unique panel that is used to monitor the status of the 120mm main gun. The panel shall contain the following:

(a) ROUND LOADED shall indicate that a virtual round is loaded in the breech.

(b) ROUND UNLOADED shall indicate that the breech is unloaded.

(c) BREECH CLOSED shall indicate that the breech is closed.

(d) BREECH ACCESSIBLE shall indicate that the breech is in a position to be opened.

(e) BREECH OPENED shall indicate that the breech is opened.

(f) STUB DEFLECTOR UP shall indicate that the stub deflector is in the up position.

(g) STUB DEFLECTOR DOWN shall indicate that the stub deflector is in the down position.

(14) The coax machine gun ammo supply, load and unload functions as follows:

(a) CANS IN STORAGE - shall be a trainer unique panel used to monitor the storage and control the removal of cans of ammo from the 7.62mm ammo storage area. The following components shall be provided:

i. CANS IN STORAGE shall be a 2 digit display that indicates the simulated number of ammo cans in the ammo storage area.

ii. TRANSFER A CAN TO READY shall be a pushbutton switch that initiates the simulated transfer of a ammo can from the storage area to the 7.62mm coaxial machine gun feed chute.

(b) ROUNDS IN READY BOX - shall be a trainer unique panel indicating the number of rounds in the ready box.

(c) MACHINE GUN - shall be a trainer unique panel used to control and monitor the loading and unloading of the 7.62mm coaxial machine gun. The following components shall be provided:

i. LOAD/UNLOAD shall be a pushbutton switch that when depressed initiates the loading of the 7.62mm coaxial machine gun if unloaded or the simulated unloading of the 7.62mm coaxial machine gun if loaded.

ii. LOADED indicator shall be a red indicator that illuminates when the 7.62mm coaxial machine gun is loaded. The indicator shall flash during the simulated load time.

iii. UNLOADED indicator shall be a green indicator that illuminates when the 7.62mm coaxial machine gun is unloaded. The indicator shall flash during the simulated unload time.

(15) Coax ammunition ready box shall be a mock-up.

(16) Coax ammunition feed chute shall not be replicated.

(17) Azimuth travel lock shall not be replicated.

(18) Loader's seat assembly shall replicate the actual M1A2 loader's seat and shall include the full range of motion and adjustments except that the seat back shall not fold down. The seat shall include the following:

(a) Height adjustment lever,

(b) Swing latch,

(c) The capability of simulating vehicle vibrations via an embedded speaker or transducer as specified in J.30.1.1.7.6.

(19) Ready rack ammo status shall be eighteen trainer unique indicators. These indicators shall indicate the number of virtual rounds being stored. If rounds are being stored, these indicators shall indicate what type, "SABOT" or "HEAT".

(20) SEMI-READY AMMUNITION RACK - shall be a trainer unique panel used to monitor the storage and control the removal of rounds from the semi-ready rack. The following components shall be provided:

(a) AMMO DOOR OPEN/CLOSE switch shall be a pushbutton switch that when depressed initiates the simulated opening of the semi-ready rack door if closed or the simulated closing of the semi-ready rack door if open.

(b) AMMO DOOR OPEN indicator shall be a red indicator that illuminates when the semi-ready rack is open. The indicator shall flash during the simulated opening time.

(c) AMMO DOOR CLOSED indicator shall be a green indicator that illuminates when the semi-ready rack is closed. The indicator shall flash during the simulated closing time.

(d) HEAT indicator shall be a two digit display that indicates the number of virtual HEAT rounds stored in the semi-ready rack. The display shall be blank when the AMMO DOOR CLOSED indicator is illuminated.

(e) REMOVE FROM RACK switch shall be a pushbutton switch that initiates the removal of a virtual HEAT round from the semi-ready rack. The switch shall be inoperative when the AMMO DOOR CLOSED indicator is illuminated.

(f) APFSDS indicator shall be a two digit display that indicates the number of the virtual SABOT rounds stored in the semi-ready rack. The display shall be blank when the AMMO DOOR CLOSED indicator is illuminated.

(g) REMOVE FROM RACK switch shall be a pushbutton switch that initiates the removal of virtual SABOT round from the semi-ready rack. The switch shall be inoperative when the AMMO DOOR CLOSED indicator is illuminated.

(21) HULL AMMUNITION RACK - shall be a trainer unique panel used to monitor the storage and control the removal of rounds from the hull ready rack. The time delays associated with the manual operation of the ammunition door, door clamps, and clamp bar shall be simulated in the design of the ammunition transfer. The panel shall be active only when the turret is positioned between 300 and 310 degrees (0 degrees is when the main gun is pointing forward and aligned with the vehicle centerline). The following components shall be provided:

(a) AMMO DOOR OPEN/CLOSE switch shall be a pushbutton switch that when depressed initiates the simulated opening of the hull ammo rack door if closed or the simulated closing of the hull ammo door if open.

(b) AMMO DOOR OPEN indicator shall be a red indicator that illuminates when the hull ammo door is open. The indicator shall flash during the simulated opening time.

(c) AMMO DOOR CLOSED indicator shall be a green indicator that illuminates when the hull ammo door is closed. The indicator shall flash during the simulated closing time.

(d) HEAT indicator shall be a two digit display that indicates the number of virtual HEAT rounds stored in the hull ammo rack. The display shall be blank when the AMMO DOOR CLOSED indicator is illuminated.

(e) REMOVE FROM RACK switch shall be a pushbutton switch that initiates the removal of a virtual HEAT round from the hull ammo rack. The switch shall be inoperative when the AMMO DOOR CLOSED indicator is illuminated.

(f) APFSDS indicator shall be a two digit display that indicates the number of the virtual SABOT rounds stored in the hull ammo rack. The display shall be blank when the AMMO DOOR CLOSED indicator is illuminated.

(g) REMOVE FROM RACK switch shall be a pushbutton switch that initiates the removal of virtual SABOT round from the hull ammo rack. The switch shall be inoperative when the AMMO DOOR CLOSED indicator is illuminated.

(22) Loader’s NBC hookups are as follows:

(a) Mask air duct socket shall be physically and functionally replicated.

(b) Cooling Vest air duct socket shall be physically replicated.

(c) Cooling Vest air duct socket cap shall be physically and functionally replicated.

(23) Loader’s Condition indicator - shall be a trainer unique 2 lamp assembly. An amber lamp shall be illuminated when the loader is considered to be wounded; a red lamp shall be illuminated when the loader is considered dead.

(24) Shoulder guard shall be physically and functionally replicated.

(25) Knee guard shall be physically and functionally replicated.

(26) Deleted

(27) Safety guard shall be physically and functionally replicated. The following related items will be replicated as follows:

(a) Frame shall be physically and functionally replicated.

(b) Latch bolt shall be physically and functionally replicated.

(28) Foot guard shall be physically and functionally replicated.

30.1.2.2.4 120 mm Main Gun.

The following controls, indicators, and other pieces of equipment shall be provided in the locations as found in the actual M1A2.

a. The following controls, indicators, and other pieces of equipment shall be simulated as follows:

(1) Breechblock shall be a mock-up.

(2) SAFE/ARMED switch handle shall be a two position handle assembly for arming and disarming main gun firing circuit.

(3) Coaxial machine gun mount shall be a mock-up.

(4) Ejection chute shall be a mock-up.

(5) Machine gun firing solenoid shall be a mock-up.

(6) 7.62 mm coaxial machine gun shall be a partial mockup. The forward portion of the 7.62 mm coaxial machine gun shall not be replicated due to the fact that it falls outside of the boundaries of the M1A2 module.

(7) The following items will not be replicated due to the fact that they would fall behind these shields and guards:

(a) Fire Control Electronics Unit (FCEU),

(b) Thermal Imaging Control Unit (TEU),

(c) Thermal Imaging Control Power Control Unit (PCU).

(8) Hull/Turret Slipring guards shall be mockups. The Hull/Turret slipring shall not be replicated due to the fact that it falls behind these shields.

30.1.2.2.5 Trainer unique - Common.

The following controls, indicators, and other pieces of equipment shall be trainer unique equipment common to all M1A2 simulation systems.

a. The following controls, indicators, and other pieces of equipment shall be simulated as follows:

(1) Simulated compass (grid azimuth indicator) shall be a three digit display depicting the orientation of the long axis of the vehicle on the simulated terrain referenced to grid north. The simulated compass shall be available inside the compartment only after the vehicle has been stationary for 15 seconds.

(2) Turret/hull reference indicator shall be a series of indicators displaying the direction/orientation of the turret relative to the hull, +/- 15 degrees.

30.1.2.2.6 Commander’s Popped Hatch Unique Components.

The following controls, indicators, and other pieces of equipment shall be provided in the locations as found in the actual M1A2, except as stated otherwise.

a. The following controls, indicators, and other pieces of equipment shall be simulated (functional):

(1) Binocular capability shall be provided by a trainer unique device as follows:

(a) A momentary pushbutton switch shall be provided which, when depressed, will enable the binocular capability on the CPH display.

(b) A two axis joystick shall be provided which, when the momentary pushbutton is depressed, shall slew the binocular reticle in azimuth and the CPH imagery in elevation.

(2) Night vision goggles shall be functionally replicated as follows:

(a) A trainer unique momentary pushbutton switch shall be provided which will enable and disable the night vision capability.

(b) When the night vision capability is activated, the CPH shall display night vision imagery.

(c) Deleted.

30.1.2.3 External Interface Unit.

The M1A2 manned module shall be provided with an External Interface Unit (EIU) that consists of an entry device and display device.

The EIU shall be used to display the following information:

a. Exercise number,

b. Vehicle identification number.

The EIU shall be used to control and monitor the following M1A2 functions:

a. Initiation and termination of self-repairs,

b. Initiation and termination of fuel transfers,

c. Initiation and termination of ammo transfers,

d. deleted,

e. Connection and disconnection of a tow kit to another vehicle,

f. External munitions loading,

g. Damage assessment.

h. Load SINCGARS hopset and COMSEC data.

APPENDIX K
M981 FIST-V MANNED MODULE

10. Scope.

This appendix establishes requirements for the M981 Fire Support Team Vehicle (FIST-V) manned module.

20. Applicable Documents.

(This section is not applicable to this appendix.)

30. Requirements.

30.1 M981 FIST-V simulator module.

The M981 FIST-V simulator shall be designed to replicate the performance characteristics of the M981, full tracked armored fire support personnel carrier and associated systems based on a M113A3 chassis as described in paragraphs K.30.1.1 through K.30.1.2.6.

30.1.1 Performance characteristics.

The following paragraphs contain the minimum detailed performance requirements that shall be provided with the M981 FIST-V manned module. The M981 FIST-V manned module shall also meet the generic design requirements of paragraph 3.6.

30.1.1.1 Deleted.

30.1.1.2 Vehicle weapon systems.

The vehicle weapons system for the M981 FIST-V manned module shall have the capability for target sighting, aiming and firing of the M60 7.62 MM Machine Gun and the M257 Smoke Grenade Launcher. The simulated vehicle weapons system components shall replicate the operational equipment in both design and performance. The vehicle weapons system shall consist of:

a. M60 7.62 MM Machine Gun.

b. M257 Smoke Grenade Launcher.

The components in combination with other simulated systems in the M981 FIST-V simulation systems shall provide the crew the capability to engage targets from a stationary position with a precision that matches real world results.

30.1.1.3 M981 FIST-V Weapons and Ammunition.

The M981 FIST-V simulation system shall simulate the following weapons and ammunition:

a. M60 7.62 MM Machine Gun (A141, Ball, Tracer).

b. M257 Smoke Grenade Launcher System (Smoke Grenade Arming Firing Unit) using the L8A3 RP smoke grenades.

30.1.1.4 Support Systems.

30.1.1.4.1 Electrical System.

The electrical system shall be capable of the following states:

a. Engine off, master power off.

b. Engine off, master power on.

c. Engine running, alternator working.

d. Engine running, alternator not working.

Based on which operating state the electrical system is in, the associated problems and abilities shall be reflected in the M981 simulation system. These problems and abilities shall be replicated in the M981 simulation systems just as they would occur in the operational equipment.

30.1.1.4.2 Hydraulic System.

The hydraulic system shall simulate the control of the elevation and azimuth of the targeting head and erecting and stowing the turret head.

30.1.1.5 Depletable resource management.

Depletable resource management shall cover the management, consumption, and resupply of both fuel and ammunition. The fuel for the M981 FIST-V manned module shall be based on the fuel contained in a M113A3's fuel tanks. The resupply of fuel from a fuel carrier (M1091 MTV or M978 HEMITT) shall be accomplished through coordination with the ALOC. The maximum ammunition capacity for the M981 FIST-V simulation system shall be based on the internal storage capabilities of the actual M981 FIST-V for the weapons identified in K.30.1.1.3. The identification, transfer, and resupply of ammunition shall be the responsibility of the vehicle commander. The resupply of ammunition from a M977/M985 HEMITT shall be coordinated through the ALOC. In all cases, the monitoring of, use of, and resupplying of the M981's fuel and ammunition shall be based on the implementation of representative time and depletion parameters. These parameters shall include:

a. Transfer times.

    (1) Fuel from a fuel carrier and fuel pre-stock to the M981 FIST-V.

    (2) Ammunition from an ammunition truck, another M981 FIST-V, and Manned Module with comparable ammunition.

    (3) Ammunition from prepositioned ammunition stocks to the M981 FIST-V.

    (4) Reload times for the weapons listed in paragraph K.30.1.1.3.

b. Depletion rates.

(1) Fuel available related to the M981 FIST-V consumption rate.

(2) Ammunition basic allowance for the various weapons listed in K.30.1.1.3.

30.1.1.6 Damage and Failure.

The list of components that shall be modeled for combat damage, stochastic failure, and deterministic failure shall be as defined in Table K-I.

Table K-I. M981 FIST-V Failures and Damage

Component/System	Deterministic	Stochastic	Combat Damage
Air Filter		X	
Alternator		X	X
Antenna A, B, C, and D			X
Batteries		X	X
Bilge Pump		X	
Commander			X
FED			X
Driver			X
Drown	X		
Engine Assembly			X
Engine Cooling System		X	X
Engine Oil System		X	X
Engine Starter	X	X	X
Erection Arm			X
Fuel Filter		X	
Gunner			X
Intercom		X	X
Laser Designator Range Finder			X
Left Idler Wheel			X
Left Roadwheel 1			X
Left Roadwheel 2			X
Left Roadwheel 3			X
Left Roadwheel 4			X
Left Roadwheel 5			X

Table K-I. M981 FIST-V Failures and Damage			
Component/System	**Deterministic**	**Stochastic**	**Combat Damage**
Left Sprocket			X
Left Track	X	X	X
North Seeking Gyro			X
Observer			X
PLGR	X		
Radio A		X	X
Radio B		X	X
Radio C		X	X
Radio D		X	X
Right Idler Wheel			X
Right Roadwheel 1			X
Right Roadwheel 2			X
Right Roadwheel 3			X
Right Roadwheel 4			X
Right Roadwheel 5			X
Right Sprocket			X
Right Track	X	X	X
Rollover	X		
Service Brake		X	
Targeting Station Hydraulic Electric Power			X
Transmission Assembly		X	X
Transmission Oil Filter		X	

30.1.1.7 Sound generation system.

A sound and acoustic vibration generation system shall be provided. The sound system shall be completely separate from the communication system, and the sounds and vibrations shall be presented independently from any headphone system (i.e. multiple loudspeakers). The sounds and vibrations shall be of such fidelity, quality, realism, and volume that crew members shall experience the cues, stresses, and distractions of a “real life” combat situation. The sounds shall be of sufficient volume so that the distractions provided to the crew members shall equal that found in an actual situation, but in no case shall 95 dB be exceeded for steady state noise (measured external to the CVC helmet). Table G-II lists the sound cues that shall be provided in the M1A1 simulation system.

Table K-II. M981 FIST-V Sound Cues
SOUND CUE
Engine noise related to Revolutions Per Minute (RPM)
Starter
Collisions with objects (scraping and hard collisions)
Track noise related to speed for terrain types simulated in CCTT
Track popping (about to be thrown)
Horn
Bilge pumps
Transmission noise related to RPM
Target Head Erect and Stow
M60 Machine Gun firing
M257 Smoke Grenade Launcher firing
Changes in target head elevation and azimuth based on speed
Engine start to idle
Engine stop
Friendly and hostile main gun fire
Friendly and hostile missile launch
Friendly and hostile rocket launch
Generic explosive sound (main gun, missile, rocket) hit
Generic explosive sound (main gun, missile, rocket) miss
Generic kinetic round hit
Friendly and hostile machine gun fire - large caliber
Friendly and hostile machine gun fire - small caliber
Friendly and hostile mine hit
Friendly and hostile bomb hit
Friendly and hostile bomb miss
Friendly and hostile artillery hit
Friendly and hostile artillery miss
Wheeled vehicle - large class
Wheeled vehicle - small class
Tracked vehicle
Aircraft - rotary wing class
Aircraft - fixed wing class

30.1.1.7.1 Sound Synchronization.

The sound system shall be synchronized with the visual displays and the M981 FIST-V controls within the system latency requirements, as defined in paragraph 3.2.2.1, and within the module latency requirements, as defined in paragraph 3.2.2.2.

30.1.1.7.2 Sound generator.

During real-time operation, the desired sounds shall be stored in the sound system and shall be available in real-time to the vehicle simulator. The system shall provide outputs for driving speakers and subwoofers. The sound generation system shall have the ability of generating a minimum of eight sounds simultaneously with full parametric control of frequency and volume. Where appropriate, sound generation channels shall be "shared" by several different sounds on a priority basis. The number of sound generation channels shall be expandable to allow for future needs that may require the capability to generate a larger number of sounds simultaneously.

30.1.1.7.3 Sound Storage.

The M981 Simulation system shall have the capacity to store all sound data and shall be expandable to allow for future increases in storage that would be necessary to generate a larger base of sound data.

30.1.1.7.4 Spatial positioning.

The sounds shall be synchronized with the actions causing the sounds and shall be presented to allow personnel the ability to identify the distance (amplitude and time delay) of the events causing the sounds.

30.1.1.7.5 Audio amplifiers.

The audio amplifiers shall be of sufficient quality and power-handling ability to recreate the required volume levels without distortion greater than 0.05 percent Total Harmonic Distortion (THD) over the dynamic range.

30.1.1.7.6 Speakers.

Audio cues shall be presented via speakers contained in the manned module crew compartment. The speaker configuration for each manned module shall be as defined in Table K-III. Headphones shall not be required to present the ambient "sounds of battle." Vibration cues (e.g. vehicle vibrations, weapons fire, and vibrations from explosions) shall be presented to the crew members through the use of subwoofers. Speaker placement within the module shall support spatial positioning.

Table K-III. M981 FIST-V Module Speaker Arrangement

MODULE TYPE	SPEAKER	SEAT SPEAKER	SUBWOOFER
M981 FIST-V	4	4	1

30.1.1.7.7 Sound quality.

The sound generator shall provide a frequency range of 25 Hertz (Hz) +/- 5 Hz to a minimum of 12,000 Hz. The audio amplifiers shall provide a frequency range of 25 Hz +/- 5 Hz to a minimum of 20,000 Hz. The combined signal to noise ratio of the sound generator and audio amplifiers shall be a minimum of 70 dB. The combination of speaker types shall provide a composite frequency response of 25 Hz to 20,000 Hz +/- 10 dB (after each speaker has been independently referenced to 0 dB).

30.1.1.8 Communication system.

A communication system shall be provided to the M981 FIST-V manned module as described in section 3.7.6 of this specification.

30.1.1.9 Visual display system (MANPRINT).

The visual display system shall meet the requirements stated in Appendix A, Visual System For The Close Combat Tactical Trainer.

30.1.2 Physical characteristics.

The following paragraphs contain the detailed physical requirements for the individual crew stations within each M981 FIST-V simulator system. The M981 FIST-V crew compartment shall exist as a consolidated enclosure for the driver's station, targeting station, communications station, and observation station. The crew stations shall be located relative to each other as they are in the actual vehicle. Each crew station shall include a seat replicating the respective seat found in the operational M981 FIST-V vehicle. The module base shall provide support for all module components and shall incorporate forklift provisions to facilitate handling and transportation. The M981 FIST-V manned modules shall provide the controls, switches, indicators and space constraints required to meet the training tasks, while avoiding negative training. Some of these items shall be fully replicated while others shall be mock-ups to provide the tactile sensations and space constraints of the actual vehicle. These controls and indicators shall replicate in design, performance, and function their real world counter-parts that are found in the operational M981 FIST-V based on a M113A3 chassis. Functional controls, indicators and other pieces of equipment shall have proper coloring and labeling.

30.1.2.1 Driver's Station.

The following buttons, controls, gauges, lights, and switches shall be provided at the driver's station in the locations and panels as found in the actual M981 FIST-V based on a M113A3 chassis.

a. Driver's distribution box shall be functionally replicated as follows:

(1) EQPT BAT voltage indicator shall display the output voltage of the equipment batteries. This voltage shall be displayed when the EQPT BAT switch is in the "ON" position, and the VEHICLE BAT switch is in the "OFF" position. The output voltage of the alternator shall be displayed when the engine is running. This gauge shall indicate battery and alternator condition as follows:

(a) The needle shall be positioned in the Lower Red Zone (low voltage) when the voltage is below 22 volts.

(b) The needle shall be positioned in the Yellow Zone (intermediate voltage) when the voltage is between 22 -26 volts.

(c) The needle shall be positioned in the Green Zone (operating voltage) when the voltage is between 26 - 30 volts.

(d) The needle shall be positioned in the Upper Red Zone (excessive voltage) when the voltage is greater than 30 volts.

(2) EQPT BAT switch shall be a three position pull to turn rotary switch. This switch shall connect the equipment batteries to electric circuits for powering the communications equipment and the targeting station when in the "ON" position.

(3) EMERGENCY switch shall be a three position pull to turn rotary switch. This switch which shall connect the equipment batteries to the vehicle battery circuit when in the "ON" position and the EQPT BAT switch is also in the "ON" position. VEHICLE BAT switch shall be a three position pull to turn rotary switch. This switch shall connect the vehicle batteries to electric circuits for power vehicle loads when in the "ON" position. This switch shall allow the alternator to charge the equipment batteries when in the "ON" position and the engine is running. UTILITY outlet shall be a mockup of the real connector and shall be nonoperational and nonfunctional. AUX POWER receptacle shall be a full size mockup of the real receptacle and shall be operational but nonfunctional.

b. Driver's instrument panel shall be simulated and shall contain the following active switches and indicators:

(1) START switch shall be a momentary pushbutton which shall engage the engine starter.

(2) BATTery GENerator INDICATOR shall be a functional gauge which shall indicate battery and generator conditions as follows:

Left red zone: Indicates low battery charge with engine off.

Yellow zone: Indicates normal battery voltage with engine off. Indicates generator not charging with engine running.

Green zone: Indicates generator charging normally with engine running.

Right red zone: Indicates generator overcharging with engine running.

(3) FUEL TANK switch shall be a two position toggle switch which allows the driver to read fuel in the LEFT and RIGHT external fuel tanks.

(4) FUEL LEVEL indicator shall be a meter assembly with the following positions (E, ¼, ½, ¾, F) which shall indicate level of fuel in LEFT and RIGHT external fuel tanks as selected using the FUEL TANK switch.

(5) Light switch assembly shall be simulated and fully functional.

(a) Panel light switch shall be a four position rotary switch which shall control the panel lights as follows:

PANEL BRT position: Panel lights are brightly lit.

OFF position: Panel lights are off.

DIM position: Panel lights are dimly lit.

PARK position: Stop lights and tail lights are lit.

(b) Lights UNLOCK switch shall be a spring-loaded, two-position lever. When held in the UNLOCK position, this lever will allow Driving Lights switch to be moved from BO MARKER to BO DRIVE, from OFF to STOP LIGHTS, and from STOP LIGHTS to SERVICE DRIVE. The lever shall return to the locked position when released.

(c) Driving lights/main light switch shall be a five position rotary switch which shall control exterior lights as follows:

B.O. DRIVE position: Enables the I.R. - B.O. SELECT switch to choose either infrared (non-functional) or blackout mode (functional) for night driving.

B.O. MARKER position: Blackout marker lights are lit. Blackout stoplight lights when brakes are applied.

OFF position: All exterior lights are off.

STOPLIGHT position: Stoplight lights when brakes are applied.

SERvice DRIVE position: Service headlights and taillights are lit. Stoplight lights when brakes are applied.

(6) Speed/Odometer shall be an active gauge and an active 6 digit display. The speed gauge shall represent the carrier speed in miles per hour, and the odometer shall indicate total carrier distance traveled in miles.

(7) MASTER SWITCH ON indicator shall be a red colored indicator which shall come on when Master Power is available.

(8) Engine coolant TEMPerature indicator shall be a functional gauge which shall indicate the engine operating temperature in degrees Fahrenheit.

(9) RPM HUNDREDS gauge (tachometer) shall be a functional gauge indicating the engine speed in revolutions per minute (RPM). The engine hour meter shall be a six digit inactive display.

(10) TRANSmission FILTER CLOGGED warning light shall ba a red colored indicator which shall come on when the transmission filter is clogged and the engine is running.

(11) PARKING BRAKE indicator light shall be a red colored indicator which shall come on when the parking brake is set.

(12) Instrument panel lights shall be two red colored indicators which are controlled by the panel lights switch.

(13) I.R. POWER switch shall be a two position toggle switch which shall be operational but nonfunctional.

(14) I.R.-B.O. SELECT switch shall be a two position toggle switch which shall be functional only in the BO position.

(15) AIR BOX HEATER switch shall beoperational but nonfunctional.

(16) BILGE PUMPS switch (FRONT and REAR) shall be a two position toggle switch which shall turn front and rear bilge pumps on and off..

(17) BILGE PUMPS lights shall be two red colored indicators which shall light when the BILGE PUMPS switch is moved to the ON position..

(18) HEADLIGHTS HI BEAM indicator light shall be a red colored indicator which shall light when headlight high beams are on.

(19) TRANSmission OIL LOW PRESSure warning light shall be a red colored indicator which shall come on when the transmission oil pressure is low.

c. Driver's Front Warning Light Panel shall be simulated and contain the following switches and indicators:

(1) ENGINE COOLANT LOW PRESSURE warning light shall be a red colored indicator which shall come on when the coolant level is too low for safe operation.

(2) TRANS OIL-HI TEMP warning light shall be a red colored indicator which shall come on when the transmission oil temperature is too high for safe operation.

(3) ENGINE OIL-LOW PRESSure warning light shall be a red colored indicator which shall come on when the oil pressure is too low for safe operation. Light shall go off 10 +/- 1 seconds after the engine starts.

(4) STEERING LOCKED indicator light shall be a red colored indicator which shall come on when steering wheel is locked in center position.

(5) HORN Button shall be a pushbutton which shall sound the carrier horn internal to the carrier.

d. Intercommunication Unit Control shall be replicated and function as described:

(1) Talk switch shall be a five position rotary switch. This switch shall allow the driver to select one of the four radios to transmit and receive on, or to select the intercom only.

(2) Listen switches shall be four 2-position toggle switches. These switches allow the driver to select up to four radios to receive only. When the switch is in the up position, that radio will be monitored.

(3) Volume switch shall be a potentiometer. This switch shall control the volume level of the intercom control unit.

(3) deleted

(4) The intercom panel shall contain two jacks to allow connection of a real CVC helmet to the intercom system.

e. Steering wheel shall be a functional assembly and when rotated shall provide the range of motion of the M981 FIST-V steering wheel assembly based on a M113A3 steering wheel assembly. Deflections of the steering wheel from the center position shall cause the carrier to turn. Clockwise deflection (as viewed from above) shall cause the carrier to turn to the right. Counterclockwise deflection shall cause the carrier to turn to the left. Steering control deadband shall be 10 degrees +/- 5 degrees. Amount of travel of the steering wheel assembly shall be 60 degrees +/- 9 degrees. Breakaway force of the steering mechanism shall be 4.0 pounds +/- 2.5 pounds. Ending force shall be 24.0 pounds +/- 4.0 pounds. Specified breakaway and ending forces shall apply to deflection in either direction.

f. Fuel cutoff control shall be a two position handle assembly that when pulled shall stop fuel flow and when pushed in shall start fuel flow to the engine. The force required for handle movement shall be constant force of 20.0 pounds +/- 4.0 pounds. The travel distance for handle movement shall be 1.25 inches +/- 0.5 inches.

g. Transmission controller shall be a seven position lever assembly that selects the driving range of the carrier automatic transmission. The SL (steering lock) position shall lock the steering wheel in the center position. This position shall be used during starting, idling, and engine shut down. The R (reverse) position shall be used for backing the carrier on land or in the water. The PV (pivot carrier) position shall be used to turn the carrier on it's own center. The 1-4 position shall be used to drive the carrier in normal forward operation. The 1-3 position shall be used when climbing and going down slight grades, driving cross country at high speeds, and driving on roads at moderate speeds. The 1-2 position shall be used when climbing and going down medium grades, driving cross country at slow speeds, and while in the water. The 1 position shall be used when climbing and going down steep grades, and when entering and leaving the water. This range shall provide maximum traction, low speed maneuvering, and engine braking. The transmission controller shall be actual equipment.

h. Accelerator pedal upper and lower shall be simulated as follows:

(1) Upper accelerator pedal shall be operational and functional.

(2) Lower accelerator pedal shall be a functional assembly that when operated shall control engine speed. The force required for pedal movement shall be 8.0 pounds +/- 2.0 pounds breakaway and 22.0 pounds +/- 4.0 pounds ending. The travel distance for pedal movement shall be 2.0 inches +/- 0.5 inches at the center of the pedal.

i. Driver's Periscopes - Four vision blocks (periscopes) shall be provided to the driver and shall display scenes generated by the visual system as specified in Appendix A.

j. Dome light shall be simulated and fully functional. The panel shall have a three position rotary switch which selects blackout or white light. The switch shall have a spring loaded, mechanical only, release button which shall prevent motion from blackout to white, by using a physical block, until button is pressed allowing traversal. The panel shall contain a blackout light and a white light. The dome light shall be located on the left side of the carrier near the driver.

k. Ramp control handle shall be a two position lever assembly that when operated simulates raising and lowering the ramp. The force required for handle movement shall be 1.0 pound +/- 0.5 pounds breakaway and 6.0 pounds +/- 1.0 pound ending. The amount of travel for handle movement shall be 45.0 degrees +/-7.0 degrees.

(1) Not used.

(2) Not used.

(3) Not used.

l. Night vision goggles shall be functionally replicated as follows:
A trainer unique momentary pushbutton switch shall be provided to the driver which

will enable and disable the night vision capability for both the driver and the commander. The commander will not have independent control of his night vision capability.

m. Drivers seat shall be fully simulated in the functionality of the operational M981 FIST-V.

(1) Driver's seat assembly shall be a seat assembly to provide all adjustments and range of motion required for closed hatch driving as on the M981 FIST-V driver's seat assembly. The back rest shall provide back support as on the M981 FIST-V driver's seat back rest.

(2) Horizontal control handle shall be a two position lever assembly mechanically connected to lock and release the driver's seat. The horizontal control handle shall mechanically allow the seat to be moved to the front or the rear. The handle shall be pulled up while the correct position is being selected. When positioned correctly, the handle shall be released to lock the seat in place.

(3) Vertical control handle shall be a two position lever assembly mechanically connected to lock and release the driver's seat. The vertical control handle shall mechanically allow the seat to be raised or lowered. The handle shall be pulled up while the correct position is being selected. When positioned correctly, the handle shall be released to lock the seat in place.

(4) The drivers seat assembly shall be provided with a mechanically operable seat belt.

n. Brake pedals upper and lower shall be simulated as follows:

(1) Upper brake pedal shall be operational and functional. The travel distance for pedal movement shall be 4.0 inches +/- 2.0 inches.

(2) Lower brake pedal shall be a functional assembly that when operated shall slow and stop the carrier. The force required for pedal movement shall be 4.0 pounds +/- 1.0 pound breakaway and 45.0 pounds +/- 10.0 pounds ending. The travel distance for pedal movement shall be 4.0 inches +/- 2.0 inches.

o. Beam selector switch shall be a push button switch that when operated shall select high or low headlight beams.

p. Parking brake handle shall be a two position handle assembly that when operated shall engage and disengage the parking brake. The force required for handle movement shall be 2.0 pounds +/- 1.0 pounds breakaway and 12.0 pounds +/- 3.0 pounds ending. The travel distance for handle movement shall be 90 degrees +/- 5 degrees.

q. Tow start handle shall be a two position handle assembly that is operational but nonfunctional.

r. Air cleaner indicator shall be simulated using a functional gauge which shall show the status of the air cleaner element with green to red indications.

s. Hand throttle control shall be a push -pull assembly that when operated shall allow engine speed to be controlled by hand. The force required for handle movement shall be 4.5 pounds +/- 1 pound. The travel distance for handle movement shall be 1.5 inches +/- 0.5 inches.

t. Driver's Condition indicator - shall be a trainer unique 2 lamp assembly. An amber lamp shall be illuminated when the driver is considered to be wounded; a red lamp shall be illuminated when the driver is considered to be dead.

u. Driver's Head Tracker - is a trainer unique item which shall provide feedback indicating where the driver's head is located and shall be used for vision block control in the driver's periscopes.

v. Driver's Level indicator shall be functionally replicated by the following components:

(1) Degree scale and dial shall be a gauge indicating the sideward slope of the vehicle. This gauge shall indicate sideslopes up to 20 degrees.

(2) Light switch shall be a push and pull switch. This switch shall turn the light above the degrees scale on and off.

(3) Lamp shall be a red lamp used to illuminate the dial scale and degree scale.

w. VFM POWER switch shall be 2-position toggle switch. This switch shall turn the blower in the precleaner and particulate filter assembly on and off.

x. Ventilated Face Mask Heater shall be functionally replicated as described:

(1) CONTROL KNOB shall control the status of the Ventilated Face Mask heater lamp.

(2) POWER LIGHT shall be a green colored indicator. This light shall illuminate when the Ventilated Face Mask Heater control knob is in the on position.

30.1.2.2 Targeting station.

The following buttons, controls, gauges, lights, and switches shall be provided at the Targeting station in the locations and panels as found in the actual M981 FIST-V.

a. Targeting Station Controls and Display(TSCD) shall be functionally replicated as described:

(1) Targeting station display shall be a 12 character 5X7 dot matrix display used to provide information to the targeting station operator.

(2) VEH GRID key shall be a pushbutton switch. This switch shall be used to view, modify, and send vehicle position data to the NSG.

(3) TGT GRID key shall be a pushbutton switch. This switch shall be used to view and modify target position data stored in the TSCD.

(4) ’1’ key shall be a pushbutton switch. This switch shall be used to enter numeric instructions or values into the TSCD.

(5) ’2’ key shall be a pushbutton switch. This switch shall be used to enter numeric instructions or values into the TSCD.

(6) ’3’ key shall be a pushbutton switch. This switch shall be used to enter numeric instructions or values into the TSCD.

(7) HDG key shall be a pushbutton switch. This switch shall be used to display heading(azimuth) and vertical angle of the targeting head when erect and to enter this data into DMD WORD memory. This switch shall be used to display vehicle heading when targeting head is stowed.

(8) Blank key shall be a pushbutton switch. This switch shall be nonfunctional.

(9) ’4’ key shall be a pushbutton switch. This switch shall be used to enter numeric instructions or values into the TSCD.

(10) ’5’ key shall be a pushbutton switch. This switch shall be used to enter numeric instructions or values into the TSCD.

(11) ’6’ key shall be a pushbutton switch. This switch shall be used to enter numeric instructions or values into the TSCD.

(12) DMD WORD key shall be a pushbutton switch. This switch shall be used to view, modify, and send (to the FED) target azimuth (direction), range (slant distance), and elevation (vertical angle) data (known as a DMD word).

(13) GLLD CODE key shall be a pushbutton switch. This switch shall be used to enter and display the three digit GLLD code required for target designation.

(14) ’7’ key shall be a pushbutton switch. This switch shall be used to enter numeric instructions or values into the TSCD.

(15) ’8’ key shall be a pushbutton switch. This switch shall be used to enter numeric instructions or values into the TSCD.

(16) '9' key shall be a pushbutton switch. This switch shall be used to enter numeric instructions or values into the TSCD.

(17) CALC key shall be a pushbutton switch. This switch shall be used to calculate target position and vehicle position using Universal Traverse Mercator(UTM) Map System.

(18) CLR key shall be a pushbutton switch. This switch shall be used to clear error messages from the TSCD display. This switch shall also be used to clear a data entry which has not been terminated with ENTR key.

(19) '+/-' key shall be a pushbutton switch. This switch shall be used to enter numeric instructions or values into the TSCD.

(20) '0' key shall be a pushbutton switch. This switch shall be used to enter numeric instructions or values into the TSCD.

(21) ENTR key shall be a pushbutton switch. This switch shall be used to enter data into the TSCD memory or to initiate action within the TSCD.

(22) LAMP TEST/BRT key shall be a pushbutton switch. This switch shall be used to test all labeled TSCD lights including the TSCD display. This switch shall also be used to set lamp brightness.

(23) Blank key shall be a pushbutton switch. This switch shall be nonfunctional.

(24) GLLD RET BRT key shall be a pushbutton switch. This switch shall be used to adjust the brightness of LD/R reticle and to control when azimuth and elevation data appears in LD/R reticle display.

(25) NSG ALIGN key shall be a pushbutton switch. This switch shall be used to initiate NSG alignment.

(26) TEST key shall be a pushbutton switch. This switch be used to test the operation of the TSCD, LD/R, NSG, and associated circuitry. This switch shall also allow the operator to turn off the fault indicators (VEH BAT, EQP BAT, TSCD FAULT, GLLD FAULT, NSG FAULT) after fault condition has been removed.

(27) CARGO HATCH lamp shall be a yellow indicator. This lamp shall illuminated during a lamp test.

(28) Deleted

(29) EL ABOVE lamp shall be a yellow indicator. This lamp shall illuminate when the targeting head is above proper elevation position for stowing.

(30) HEAD STOW lamp shall be a white indicator. This lamp shall illuminate when the targeting head is in the stowed position.

(31) EQP BAT lamp shall be a red indicator. This lamp shall illuminate when the voltage of equipment batteries falls below 21 volts. The lamp shall remain illuminated until turned off via the Error Clear function of the TEST key.

(32) VEH BAT lamp shall be a red indicator. This lamp shall illuminate when the voltage of the vehicle batteries falls below 17.5 volts. The lamp shall remain illuminated until turned off via the Error Clear function of the TEST key.

(33) NSG FAULT lamp shall be a red indicator. This lamp shall illuminate when a fault occurs in the NSG. The lamp shall remain illuminated until turned off via the Error Clear function of the TEST key.

(34) TSCD FAULT lamp shall be a red indicator. This lamp shall illuminate when a fault occurs in the TSCD. The lamp shall remain illuminated until turned off via the Error Clear function of the TEST key.

(35) WPN HATCH lamp shall be a yellow indicator. This lamp shall illuminated during a lamp test.

(36) LASER INTRPT lamp shall be a yellow indicator. This lamp shall illuminate when any of the following laser interrupt conditions exist:

- a hatch is open,
- sight select switch on the hand controls is set to 3X,
- erect confirm switch within erection arm is not actuated (head not erect)

(37) EL STOW lamp shall be a white indicator. This lamp shall illuminate when the targeting head is in the proper elevation position for stowing.

(38) AZ STOW lamp shall be a white indicator. This lamp shall illuminate when the targeting head is in the proper azimuth position for stowing.

(39) Deleted

(40) Deleted

(41) NSG ALIGN lamp shall be a yellow indicator. This lamp shall illuminate when the NSG is in initialization, re-initialization, or realignment mode. This lamp will flash on and off if the vehicle coordinates have not been entered into the VEH GRID memory since power was last applied to the TSCD.

(42) GLLD FAULT lamp shall be a red indicator. This lamp shall illuminate when a fault occurs in the LD/R. The lamp shall remain illuminated until turned off via the

Error Clear function of the TEST key. This lamp will flash on and off until the GLLD CODE is entered after TSCD power is applied.

(43) DRIVER HATCH lamp shall be a yellow indicator. This lamp shall illuminated during a lamp test.

(44) Deleted

(45) EL BELOW lamp shall be a yellow indicator. This lamp shall illuminate when the targeting head is below the proper elevation position for stowing.

(46) HEAD ERECT lamp shall be a green indicator. This lamp shall illuminate when the targeting head is fully erect.

(47) HEAD READY lamp shall be a green indicator. This lamp shall illuminate when the erection arm locks and the GLLD locks are engaged.

(48) NSG ON lamp shall be a green indicator. This lamp shall illuminate when the NSG switch is set to ON.

(49) NSG READY lamp shall be a green indicator. This lamp shall illuminate when the NSG is in the operational mode.

(50) GLLD ON lamp shall be a green indicator. This lamp shall illuminate when the GLLD switch is set to the RNG 2, RNG 1, or the DES position.

(51) INTERRUPT switch shall be a two position toggle switch. This switch will override the laser interrupt conditions when placed in the OVERRIDE position. The switch shall be protected by a hinged cover to prevent accidental activation.

(52) HEAD switch shall be a two position toggle switch. This switch shall select the position of the targeting head (ERECT or STOW) when DRIVE switch is held in the ON position.

(53) DRIVE switch shall be a two position toggle switch springloaded to the OFF position. This switch shall turn on the erection drive causing the targeting head to move to the position selected by the HEAD switch when held in the ON position.

(54) NSG switch shall be a two position toggle switch. This switch shall turn the NSG on and off. This switch shall be pulled out to set to the ON or OFF positions.

(55) TSCD POWER switch shall be a two position toggle. This switch shall turn the TSCD on and off. This switch shall be pulled out to set to the ON or OFF positions.

(56) GLLD switch shall be a four position rotary switch. This switch shall control the operating mode of the LD/R as follows:

OFF - The OFF position shall remove power from the LD/R.

RNG 2 - The RNG 2 position shall be used for determining the position of hard targets.

RNG 1 - The RNG 1 position shall be used for determining the position of soft targets.

DES - The DES position shall cause the LD/R to operate as a continuous-pulsed laser designator.

(57) PUMP switch shall be a two position toggle switch. This switch shall remove power from the targeting station hydraulic pump when set to the DISABLE position. This switch shall be protected by a hinged cover to prevent accidental activation.

b. Hand Control Assembly shall be functionally replicated as described:

(1) HAND CONTROL shall be a potentiometer assembly and when rotated shall provide the range of motion of the M981 FIST-V hand control assembly. Deflections of the hand control from the center position shall cause the targeting head to rotate. Clockwise deflections (as viewed from above) shall cause the targeting head to rotate in a clockwise direction. Counterclockwise deflections shall cause the targeting head to rotate in the counterclockwise direction. Hand control deadband shall be 12 degrees +/- 4 degrees. Breakaway force of the hand control shall be 0.5 lbs. +/- 0.2 lbs. applied at the bottom of either handgrip. Ending force shall be 3.75 pounds +/- 1.0 pounds applied at the bottom of either handgrip. Specified breakaway and ending forces shall be apply to deflection in either direction.

(2) LEFT CONTROL GRIP shall be a potentiometer assembly and when rotated shall provide the range of motion of the M981 FIST-V left control grip assembly. Deflections of the left control grip from the center position shall cause the targeting head to elevate or depress. Forward deflections shall cause the targeting head to depress. Rearward deflections shall cause the targeting head to elevate. Left control grip deadband shall be 8 degrees +/- 3 degrees. Breakaway force of the left control grip shall be 1.0 lbs. +/- 0.5 lbs. applied at the highest point on the front of the left control grip. Ending force of the left control grip shall be 3.5 pounds +/- 1.0 pounds applied at the highest point on the front of the left control grip. Specified breakaway and ending forces shall be apply to deflection in either direction.

(3) LEFT LASER FIRING TRIGGER shall be a momentary pushbutton switch. This switch shall be used to fire the LD/R laser when depressed along with the right laser firing trigger.

(4) LEFT HANDGRIP ACTUATOR SWITCH shall be a momentary pushbutton switch. This switch shall activate the hydraulic system permitting the targeting head to be elevated/depressed and turned in azimuth at a slow rate. The switch shall also cause the LD/R to enter the AZ ADJ mode.

(5) LEFT SLEW SWITCH shall be a momentary pushbutton switch. This switch shall increase the targeting head traversing rate four times.

(6) RIGHT CONTROL GRIP shall be a potentiometer assembly and when rotated shall provide the range of motion of the M981 FIST-V right control grip assembly. Deflections of the right control grip from the center position shall cause the targeting head to elevate or depress. Forward deflections shall cause the targeting head to depress. Rearward deflections shall cause the targeting head to elevate. Right control grip deadband shall be 8 degrees +/- 3 degrees. Breakaway force of the right control grip shall be 1.0 lbs. +/- 0.5 lbs. applied at the highest point on the front of the right control grip. Ending force of the right control grip shall be 3.5 pounds +/- 1.0 pounds applied at the highest point on the front of the right control grip. Specified breakaway and ending forces shall be apply to deflection in either direction.

(7) RIGHT LASER FIRING TRIGGER shall be a momentary pushbutton switch. This switch shall be used to fire the LD/R laser when depressed along with the left laser firing trigger.

(8) RIGHT HANDGRIP ACTUATOR SWITCH shall be a momentary pushbutton switch. This switch shall activate the hydraulic system permitting the targeting head to be elevated/depressed and turned in azimuth at a slow rate. The switch shall also cause the LD/R to enter the AZ ADJ mode.

(9) RIGHT SLEW SWITCH shall be a momentary pushbutton switch. This switch shall increase the targeting head traversing rate four times.

(10) SIGHT SELECT SWITCH shall be a three position rotary switch. This switch shall select the optics to be viewed through the tank periscope eyepiece. The 13X position shall select the LD/R. The 3X position select the 3X telescope. The NIGHT position shall select the nightsight.

(11) TRIGGER LIGHT shall be a red colored lamp. The lamp shall illuminate when both laser firing triggers are depressed.

c. Azimuth Position Indicator shall indicate the azimuth position of the turret in relation to the vehicle hull.

d. Laser Designator/Range Finder shall be functionally replicated as described:

(1) RETICLE shall be a visual graphics representation containing the following elements:

(a) BURST RESOLUTION SCALE shall be represented. This scale shall measure the error (in mils) of the artillery burst from the target.

(b) CROSSHAIRS shall be represented. The crosshairs shall indicate the line-of-sight of the laser beam (where the crosshairs intersect) providing the aiming reference.

(c) AZ READOUT shall be represented. This readout shall indicate the azimuth angle in mils (four digits) of LD/R line-of-sight relative to G/VLLD zero azimuth. G/VLLD zero azimuth shall be grid north as determined by the NSG. This function shall be active in RNG 1, RNG 2, and AZ ADJ modes.

(d) RNG READOUT shall be represented. This readout shall indicate line-of-sight distance in meters (four digits) between LD/R and the target. This function shall be active in RNG 1 and RNG 2 modes.

(e) EL READOUT shall be represented. This readout shall indicate elevation angle in mils (sign and three digits) of LD/R line-of-sight relative to G/VLLD zero elevation. G/VLLD zero elevation shall be horizontal as determined by the NSG. Negative angles shall be preceded by a minus(-), positive angles by a space. EL readout shall be active in RNG 1, RNG 2, and the AZ ADJ modes.

(f) LASER FAIL INDICATOR shall be represented. This indicator shall be red in color. The indicator will illuminate when laser output is low. The indicator shall blink on and off when the laser is overheating.

(g) BATTERY FAIL INDICATOR shall be represented. This indicator shall be amber in color. This indicator shall illuminate when low battery voltage is detected.

(h) FIRE COMMAND INDICATOR shall be represented. This indicator shall be green in color. This indicator shall illuminate when designate signal is received from the FED.

e. Targeting sight eyecup shall be provided.

f. Cupola Circuit Breaker Box Controls shall be functionally replicated as described:

(1) ITU CIRCUIT BRKR SWITCH shall be a two position toggle switch. This switch shall have a safety cover. This switch shall be nonfunctional.

(2) TSCD CIRCUIT BRKR SWITCH shall be a two position toggle switch. This switch shall have a safety cover. This switch shall control the power to the TSCD microprocessor and the TSCD internal power supply.

(3) TURRET CIRCUIT BRKR SWITCH shall be a two position toggle switch. This switch shall have a safety cover. This switch shall control the power to all turret, erection arm, and targeting head components except the TSCD microprocessor and the TSCD internal power supply.

g. Fire Interrupt/Intercom Assembly shall be functionally replicated as described:

(1) EARPHONE VOLUME CONTROL shall be a potentiometer. This control shall adjust the volume to the CVC helmet earphone.

(2) FIRE INTERRUPT ALARM shall be a audible alarm. This alarm shall sound when the INTERRUPT switch is set to OVERRIDE, or when the GLLD cover is closed and the TSCD is set to RNG 1, RNG 2, or DES.

(3) The intercom panel shall contain two jacks to allow connection of a real CVC helmet to the intercom system.

h. ELAPSED TIME METER shall be a pictorial component which shall provide an example display of the total operating time of the turret in hours.

i. Targeting Station sight shall display scenes generated by the visual system as specified in Appendix A. The view displayed shall be determined by the position of the SIGHT SELECT switch on the hand control assembly. When the SIGHT SELECT switch is in the 13X position, the view displayed shall be as if looking through the LD/R. When the SIGHT SELECT switch is in the 3X position, the view displayed shall be as if looking through the 3X telescope. When the SIGHT SELECT switch is in the NIGHT position, the view displayed shall be as if looking through the nightsight. A sensor shall be provided to determine when the sight is in use and when activated, the sight shall display simulated targeting sight imagery.

j. Targeting Station Cupola Vision Blocks - 7 vision blocks (periscopes) shall be provided to the targeting station which display scenes generated by the visual system as specified in Appendix A.

k. Smoke Grenade Launcher Controls shall be functionally replicated as described:

(1) SMOKE grenade ARM-OFF switch shall be a two position toggle switch. This switch shall energize the smoke grenade circuits when in the ARM position. This switch shall be lever locked in the OFF position.

(2) SMOKE grenade POWER ON (ARM) indicator shall be a red colored light. This light shall illuminate when the ARM-OFF switch is in the ARM position.

(3) SMOKE grenade FIRE switch shall be a pushbutton switch with a protective skirt. This switch shall fire smoke grenades from the discharger tubes on the exterior of the vehicle.

l. Nightsight Remote Control Panel shall be functionally replicated as described:

(1) ON/OFF SWITCH shall be a two position toggle switch. This switch shall control power to the NIGHTSIGHT FOCUS, CTRS, and BRT controls; and the nightsight remote control panel light.

(2) FOV CONTROL shall be a push and pull switch. This switch shall control the FOV(field-of-view) through the nightsight from the targeting station. The FOV shall be set to narrow when the switch is pulled out. The FOV shall be set to wide when the switch is pushed in.

(3) FOCUS CONTROL shall be a spring-loaded toggle switch. This switch shall be non-functional.

(4) CTRS CONTROL shall be a spring-loaded toggle switch. This switch shall control the contrast of the nightsight from the targeting station.

(5) GLLD COVER CONTROL shall be a push and pull switch. This switch shall control operation of the GLLD dust cover. This switch shall open the dust cover when pulled out. This switch shall close the dust cover when pressed in.

(6) BRT CONTROL shall be a spring-loaded toggle switch. This switch shall control the brightness of the nightsight display from the targeting station.

(7) NIGHTSIGHT POWER LIGHT shall be a red colored light. This light shall illuminate the nightsight remote controls when the ON/OFF switch is set to ON.

(8) FILTER RESET/STEP switch shall be an operational and non-functional control.

m. Intercommunication Unit Control shall be replicated and function as described:

(1) Talk switch shall be a five position rotary switch. This switch shall allow the targeting station operator to select one of the four radios to transmit and receive on, or to select the intercom only.

(2) Listen switches shall be four 2-position toggle switches. These switches allow he targeting station operator to select up to four radios to receive only. When the switch is in the up position, that radio will be monitored.

(3) Volume switch shall be a potentiometer. This switch shall control the volume level of the intercom control unit.

(4) deleted

n. Ventilated Face Mask Heater shall be functionally replicated as described:

(1) CONTROL KNOB shall control the status of the Ventilated Face Mask heater lamp.

(2) POWER LIGHT shall be a green colored indicator. This light shall illuminate when the Ventilated Face Mask Heater control knob is in the on position.

o. Dome light shall be simulated and fully functional. The panel shall have a three position rotary switch which selects blackout or white light. The switch shall have a spring loaded, mechanical only, release button which shall prevent motion from blackout to while, by using a physical block, until button is pressed allowing transversal. The panel shall contain a blackout light and a white light.

p. Commander's Condition indicator - shall be a trainer unique 2 lamp assembly. An amber lamp shall be illuminated when the commander is considered to be wounded; a red lamp shall be illuminated when the commander is considered to be dead.

q. Commander's Head Tracker is a trainer unique item which shall provide feedback indicating where the commander's head is located and shall be used for vision block control in the commander's cupola.

r. Targeting Station seat shall be fully simulated in the functionality of the operational M981 FIST-V.

(1) Targeting station seat assembly shall be a seat assembly to provide all adjustments and range of motion required as on the M981 FIST-V targeting station seat assembly.

(2) Seat adjustment handle shall mechanically allow the seat to be moved to be raised or lowered. When positioned correctly, the handle shall be released to lock the seat in place.

s. Cupola controls shall allow for the simulated movement of the commanders cupola gun ring and control of the M60 machine gun.

(1) A trainer unique device shall be provided which allows for the movement of a simulated M60 machine gun sight horizontally and vertically within the commander vision blocks.

(2) A fire button shall be provided that allows for the simulated firing of the M60 machine gun.

t. ROUNDS IN STORAGE - Shall be a trainer unique panel used to monitor the storage and control the removal of ammo cans from the 7.62 mm ammo storage area. The following components shall be provided:

(1) ROUNDS IN STORAGE shall be a 4 digit display that indicates the simulated number of ammo cans in the ammo storage area.

(2) FILL WEAPON AMMUNITION BOX shall be a pushbutton switch that initiates the simulated transfer of ammo from the storage area to the M60 machine gun ammunition box.

u. ROUNDS IN AMMUNITION BOX - shall be a trainer unique panel inidicating the number of rounds in the ammunition box.

v. MACHINE GUN - shall be a trainer unique panel used to control and monitor the loading and unloading of the M60 machine gun. The following components shall be provided:

(1) LOAD/UNLOAD shall be a pushbutton switch that when depressed will initiate the loading of the M60 machine gun if unloaded and unload the the M60 machine gun if loaded.

(2) LOADED indicator shall be a green indicator that illuminates when the M60 machine gun is loaded. The indicator shall flash during the simulated load time.

(3) UNLOADED indicator shall be a green indicator that illuminates when the M60 machine gun is unloaded. The indicator shall flash during the simulated unload time.

w. Utility light shall be functional as follows:

(1) Brightness Selector shall vary the light intensity from OFF to full brightness.

(2) Momentary On Switch shall, when depressed, turn the light to maximum brightness

(3) Light Selector shall rotate to select white floodlight, white spotlight, red floodlight or red spotlight.

x. Hydraulic pressure gauge shall be functional assembly. Hydraulic pressure gauge shall display current system Hydraulic Pressure. The gauge is divided into 0 to 3 with 10 dashes between each number, numbers are X1000 PSI.

y. Manual Hydraulic Pump Handle shall be a functional assembly. The handle shall increase the pressure by 100 psi each time it is moved the full distance to a max of 1900 psi.

30.1.2.3 Communication station.

The following buttons, controls, gauges, lights, and switches shall be provided at the Communication station in the locations and panels as found in the actual M981 FIST-V.

a. Audio Frequency Amplifier (AM 1780/VRC) shall be functionally replicated as follows:

(1) MAIN PWR switch shall be a three position rotary switch with pointer knob and shall have active positions labeled “NORM”, “INT ONLY”, and “OFF”. No radio transmission shall be possible when MAIN PWR switch is in INT ONLY position. The entire communications system shall be turned off when MAIN PWR switch is in OFF position.

(2) INT ACCENT switch shall be a two position rotary switch with pointer knob and active positions labeled “ON” and “OFF”. Intercom and radio sound levels shall be equal when INT ACCENT switch is set to OFF. Radio sound levels shall be lower than intercom when INT ACCENT switch is set to ON.

(3) RADIO TRANS switch shall be a three position rotary switch with pointer knob and shall have active positions labeled “CDR + CREW”, “CDR ONLY”, and “LISTENING SILENCE”. Entire crew shall be able to transmit on radio with RADIO TRANS switch in CDR + CREW position. Only tank commander shall be able to transmit on radio when RADIO TRANS switch is in CDR ONLY position. No radio transmission shall be possible with RADIO TRANS switch in LISTENING SILENCE position.

(4) POWER CKT BKR switch shall be a two position trippable toggle type circuit breaker.

(5) POWER light shall be a green lamp and shall indicate when power is applied to the communication system.

(6) INSTALLATION switch shall be a three position rotary switch requiring a flat blade screwdriver to change switch setting and shall have active positions labeled “INT ONLY”, “OTHER”, and “RETRANS”.

(7) AUDIO INPUT jacks shall be non-operational and non-functional.

(8) LINE jacks shall be non-operational and non-functional.

b. Intercommunication Unit Control shall be replicated and function as described:

(1) Talk switch shall be a five position rotary switch. This switch shall allow the communication station operator to select one of the four radios to transmit and receive on, or to select the intercom only.

(2) Listen switches shall be four 2-position toggle switches. These switches allow the communication station operator to select up to four radios to receive only. When the switch is in the up position, that radio will be monitored.

(3) Volume switch shall be a potentiometer. This switch shall control the volume level of the intercom control unit.

(4) deleted

c. Forward Entry Device (FED) shall provide the ability to send and receive messages. The FED shall interface with the SINCGARS radio to send and receive messages. The FED shall interface with the FIST-V TSCD to locate and laser designate targets.

d. The SINCGARS (RT-1523A) shall be compatible with organizational requirements except as indicated in 3.7.6 for vehicle and headquarters radio configurations and shall allow for communication with the Operations Center (OC) and other desired units. The M981 FIST-V shall have four (4) SINCGARS radios. Each radio shall simulate the following controls:

(1) ANT connector shall be a dummy 3-D connector which shall have a dummy cable. On vehicular installations that provide a long range (lower) radio the dummy cable shall connect to the RF power amplifier. On the short range (upper) radio the dummy cable shall connect to the chassis (representing connecting to vehicle antenna).

(2) CHAN (channel) switch shall select manual, preset and cue frequencies. This switch shall be an 8 - position rotary switch with pointer knob which utilizes the following positions:

(a) CUE - This position shall allow the operator to preset SC frequency for the CUE channel or select the preset CUE frequency.

(b) MAN - This position shall allow the operator to preset SC frequency for the MAN channel or select the preset MAN frequency.

(c) 1 - This position shall allow the operator to preset an SC frequency for channel 1. This position shall also select the preset SC frequency when in SC mode and the FH hopset when in FH mode for channel 1. The loading of preset FH channels or COMSEC keys shall be simulated using the external interface unit.

(d) 2 - This position shall allow the operator to preset an SC frequency for channel 2. This position shall also select the preset SC frequency when in SC mode and the FH hopset when in FH mode for channel 2. The loading of preset FH channels or COMSEC keys shall be simulated using the external interface unit.

(e) 3 - This position shall allow the operator to preset an SC frequency for channel 3. This position shall also select the preset SC frequency when in SC mode and the FH hopset when in FH mode for channel 3. The loading of preset FH channels or COMSEC keys shall be simulated using the external interface unit.

(f) 4 - This position shall allow the operator to preset an SC frequency for channel 4. This position shall also select the preset SC frequency when in SC mode and the FH hopset when in FH mode for channel 4. The loading of preset FH channels or COMSEC keys shall be simulated using the external interface unit.

(g) 5 - This position shall allow the operator to preset an SC frequency for channel 5. This position shall also select the preset SC frequency when in SC mode and the FH hopset when in FH mode for channel 5. The loading of preset FH channels or COMSEC keys shall be simulated using the external interface unit.

(h) 6 - This position shall allow the operator to preset an SC frequency for channel 6. This position shall also select the preset SC frequency when in SC mode and the FH hopset when in FH mode for channel 6. The loading of preset FH channels or COMSEC keys shall be simulated using the external interface unit.

(3) RF PWR switch shall be a 4 position rotary switch with pointer knob, with the following positions:

(a) LO - This position shall set the transmission power to low.

(b) M - This position shall set the transmission power to medium.

(c) HI - This position shall set the transmission power to high.

(d) PA - This position shall set the operation of transmissions for use with the power amplifier, or high power if power amplifier is not connected to the RT.

(4) MODE Switch - This switch shall be a 3 - position rotary switch with pointer knob, with the following positions:

(a) SC - This position shall set the Receiver/Transmitter to SC (single channel) mode.

(b) FH - This position shall set the Receiver/Transmitter to FH (frequency hopping) mode.

(c) FH-M - This position shall set the Receiver/Transmitter to FH-M (frequency hopping master) mode. The operator shall be required to pull the switch to go into the FH-M position.

(5) RXMT connector shall be a dummy 3-D connector with a fixed dummy cable connected to the RXTM on the other RT (if it exists) in the radio mount.

(6) FCTN(function) Switch - This switch shall be a 9 - position rotary switch with pointer knob, with the following positions:

(a) STBY - This position shall turn off receiver/transmitter (RT) while maintaining memory. The operator shall be required to pull the switch knob in order to go to the STBY position.

(b) TST - This position shall cause the normal selftest indications to be displayed on the keyboard display.

(c) LD - This position shall load SC frequencies, and shall also allow the operator to receive ERF data from an RT operating in the FH-M mode.

(d) SQ ON - This position shall turn on the RT and activate the squelch.

(e) SQ OFF - This position shall turn on the RT and deactivate the squelch.

(f) RXMT - This position shall be non-functional.

(g) REM - This position shall disable the RT's front panel controls.

(h) Z-FH - This position shall clear the RT of all FH data. The operator shall be required to pull the switch knob in order to go to the Z-FH position.

(i) OFF - This position shall turn off all power to the RT. This function shall also erase the RT's memory. The operator shall be required to pull the switch knob in order to go to the OFF position.

(7) DIM Control - This shall be an active control which replicates the appearance and function of the corresponding actual knob.

(8) Keyboard Display shall display all information concerning the operation of the RT including SC frequencies, FH data, error messages, data rates as well as keyboard entries. The display shall consist of 8 full 5 X 7 dot matrix characters that are alphanumeric with the capability to display special characters. The seventh 5 X 7 dot matrix character shall be capable of displaying no dots on column number one, on column number two only displaying dots on rows one, three, five, and seven that have the capability to be lighted individually, no dots on column number three, and capable of lighting all the dots on columns four and five at the same time. An

eighth dot matrix character shall also be capable of displaying dots arranged in the form of a diamond. All displays shall be dimmable. Color of display shall be green.

(9) Keypad shall be responsible for the entering data into the RT. The keypad shall consist of the following 16 pushbutton keys:

(a) CMSC 1 - Shall display the COMSEC key identifier number on the display and enter the number '1' into the system.

(b) * 2 - Shall enter the number '2' into the system. The special feature activated by this key on the actual RT shall not be selectable or simulated.

(c) SYNC 3 - Shall place the RT into 'late entry' status allowing the RT to re-enter the network. Also shall enter the number '3' into the system.

(d) FREQ - Shall allow the operator to load and clear SC frequencies in the RT.

(e) DATA 4 - Shall display the RT's operational data rate and enter the number '4' into the system.

(f) 5 - Shall enter the number '5' into the system.

(g) 6 - Shall enter the number '6' into the system.

(h) ERF OFST - Shall transmit ERF data to net members when RT is operating in FH-M mode. Also shall load/check SC offset frequencies.

(i) CHG 7 - Shall change current information on display to another available selection. Shall also enter the number '7' into the system.

(j) 8 - Shall enter the number '8' into the system.

(k) LOUT 9 - Shall enter the number '9' into the system. Shall also retrieve frequency lockout sets from permanent memory if the RT is operating as Frequency Hop Master.

(l) TIME - Shall be used to check RT FH sync time clock.

(m) CLR - Shall clear data from display if error was made during entry. Shall also be used to clear data from RT memory.

(n) LOAD 0 - Shall load data into holding memory in RT and to retrieve data from permanent memory into holding memory. Shall also be used to enter the number '0' into the system.

(o) STO - Shall transfer data from RT holding memory onto permanent memory.

(p) BATT CALL - Shall be non-functional.

(10) COMSEC switch shall be responsible for controlling the communication security modes of the RT. It shall be a 5 - position rotary switch with pointer knob, with the following positions:

(a) PT - This position shall place the RT into plain text mode. The operator shall be required to pull the knob in order to place the knob into this position.

(b) CT - This position shall place the RT into cipher text mode.

(c) TD - This position shall be non-functional.

(d) RV - This position shall prepare the RT to receive a remote fill of COMSEC variables from the NCS.

(e) Z - This position shall clear COMSEC keys. The operator shall be required to pull the knob in order to place the knob into this position.

(11) VOL WHSP control shall be a rotational knob used for audio volume control. The knob shall also provide a pullout position which shall be non-functional.

(12) HUB Connector - Dummy cover that shall not be removable.

(13) AUD/FILL connector shall be a dummy 3-D connector.

(14) AUD/DATA connector shall be a dummy 3-D connector. In vehicular installations, a dummy cable shall connect the AUD/DATA connector and the DATA A or DATA B connector of the mounting adapter. In the M981 FIST-V radios which are used by the FED, dummy cables shall not connect to the DATA A or DATA B connectors on the mounting adapter.

e. Each SINCGARS radios shall be mounted in a short/long range radio configuration. The M981 FIST-V shall contain two of the short/long radios configurations. Each mounting shall replicate the AN/VRC-89A configuration which contains the following components:

(1) Amplifier-Adapter, Vehicular (mounting adapter) AM-7239B/VRC.
(2) Amplifier, Radio Frequency AM-7238A/VRC.
(3) Receiver-Transmitter, Radio RT-1523A.
(4) Receiver-Transmitter, Radio RT-1523A.
(5) Loudspeaker Control Unit, LS-671/U (only 1 per four radios).

The Configuration shall be replicated as follows:

(1) The mounting adapter shall have two (2) SINCGARS receiver-transmitters as described above. The mounting adapter shall have a simulated Radio Frequency Amplifier connected, and shall also have the following components.

(a) CB1 (power) switch shall be a two position trippable toggle switch with an ON and OFF position.

(b) Indicator lamp and lens shall be a green colored dimmable indicator. The indicator shall flash for 3 +/- 1 second after CB1 switch is moved to ON position, then stay lit. The lens shall allow the indicator to be dimmed by turning clockwise.

(c) The (AUD/DATA B J2) connector shall be a 3-D dummy connector.

(d) The (AUD/DATA A J3) connector shall be a 3-D dummy connector.

(e) The (DATA B J4) connector shall be a 3-D dummy connector with a dummy cable connected to the AUD/DATA connector on the top radio.

(f) The (DATA A J5) connector shall be a 3-D dummy connector with a dummy cable connected to the AUD/DATA connector on the bottom radio.

(g) The (SPKR J6) connector shall be a 3-D dummy connector.

(2) The Radio Frequency Amplifier shall be connected to the mounting adapter. TheRadio Frequency Amplifier shall have the following components.

(a) The (J1) connector shall be a dummy connector. A dummy cable which represents the connection to a vehicle antenna shall be connected to the J1 connector.

(b) The (J2) connector shall be a dummy connector. A dummy cable which also connects to the ANT connector of the RT mounted in the mounting adapter shall be connected to the J2 connector.

f. Deleted.

g. Ventilated Face Mask Heater shall be functionally replicated as described:

(1) CONTROL KNOB shall control the status of the Ventilated Face Mask Heater lamp.

(2) POWER LIGHT shall be a green colored indicator. This light shall illuminate when the Ventilated Face Mask Heater control knob is in the on position.

h. Dome light shall be simulated and fully functional. The panel shall have a three position rotary switch which selects blackout or white light. The switch shall have a spring loaded, mechanical only, release button which shall prevent motion from blackout to white, by using a physical block, until button is pressed allowing traversal. The panel shall contain a blackout light and a white light.

i. Communication station seat shall be fully simulated in the functionality of the operational M981 FIST-V.

   (1) Communication station seat assembly shall be a seat assembly to provide all adjustments and range of motion required as on the M981 FIST-V seat assembly.

   (2) Horizontal control handle shall be a two position lever assembly mechanically connected to lock and release the seat. The horizontal control handle shall mechanically allow the seat to be moved to the front or the rear. The handle shall be pulled up while the correct position is being selected. When positioned correctly, the handle shall be released to lock the seat in place.

   (3) Vertical control handle shall be a two position lever assembly mechanically connected to lock and release the seat. The vertical control handle shall mechanically allow the seat to be moved to be raised or lowered. The handle shall be pulled out while the correct position is being selected. When positioned correctly, the handle shall be released to lock the seat in place.

j. Communication Officer’s Condition indicator - shall be a trainer unique 2 lamp assembly. An amber lamp shall be illuminated when the communication officer is considered to be wounded; a red lamp shall be illuminated when the communication officer is considered dead.

k. Utility light shall be functional.

   (1) Control knob shall be a functional assembly which controls light intensity.

l. Electrical Transient Suppressor shall be functionally simulated as follows:

   (1) Circuit Breaker Switch shall be a two position toggle switch. The ON position shall enable use of the intercom system and SINCGARS radios. The OFF (circuit breaker tripped) position shall disable use of the intercom system and SINCGARS radios.

   (2) Battle Override Switch shall be a two position guarded toggle switch. When the Circuit Breaker Switch is in the OFF (circuit breaker tripped) position, placing the Battle Override Switch in the OVERRIDE position shall enable use of the intercom system and the SINCGARS radios.

m. Precision Lightweight GPS Receiver (PLGR+96 SPS) shall be physically installed as in the operational unit, except where simulated vehicle space constraints apply and functionally replicated as described in paragraph 3.7.6.4.

30.1.2.4 Observation Station.

The following buttons, controls, gauges, lights, and switches shall be provided at the observation station in the locations and panels as found in the actual M981 FIST-V.

a. Panoramic Telescope shall display scenes generated by the visual system as specified in Appendix A. The panoramic telescope shall be functionally replicated as described:

(1) Azimuth Handwheel control shall be an active assembly and shall rotate the telescope line-of-sight to the left and right.

(2) Elevation Handwheel control shall be an active assembly and shall rotate the telescope line-of-sight up and down.

(3) Eyecup shall be provided.

(4) Humidity indicator shall be operational but nonfunctional.

(5) Focus control shall be a functional assembly allowing for the simulated focus of the panoramic telescope.

b. Intercommunication Unit Control shall be replicated and function as described:

(1) Talk switch shall be a five position rotary switch. This switch shall allow the observation station operator to select one of the four radios to transmit and receive on, or to select the intercom only.

(2) Listen switches shall be four 2-position toggle switches. These switches allow the observation station operator to select up to four radios to receive only. When the switch is in the up position, that radio will be monitored.

(3) Volume switch shall be a potentiometer. This switch shall control the volume level of the intercom control unit.

(4) deleted

c. Ventilated Face Mask Heater shall be functionally replicated as described:

(1) CONTROL KNOB shall control the status of the Ventilated Face Mask Heater lamp.

(2) POWER LIGHT shall be a green colored indicator.

(3) This light shall illuminate when the Ventilated Face Mask Heater control knob is in the on position.

d. Observation station seat shall be fully simulated in the functionality of the operational M981 FIST-V.

(1) Observation station seat assembly shall be a seat assembly to provide all adjustments and range of motion required as on the M981 FIST-V.

(2) Height adjustment pin shall be a mechanical pin to lock the observation station seat in any of five different heights.

e. Observer's Condition indicator - shall be a trainer unique 2 lamp assembly. An amber lamp shall be illuminated when the observer is considered to be wounded; a red lamp shall be illuminated when the observer is considered dead.

30.1.2.5 Other Controls.

The following buttons, controls, gauges, lights, and switches shall be provided in the locations and panels as found in the operational M981 FIST-V.

a. Ventilating Fan shall be replicated and function as described:

(1) Power receptacle - This connector shall be a dummy receptacle with one discrete input which shall provide hookup for power cable.

(2) ON/OFF switch - This switch shall be a two position toggle switch with two discrete inputs which shall be used to turn on and off the ventilating fan.

30.1.2.6 Trainer Unique.

Simulated Compass (grid azimuth indicator) shall be a four digit display depicting the orientation, in mils, of the long axis of the vehicle on the simulated terrain referenced to grid north. The simulated compass shall be available inside the compartment only after the vehicle has been stationary for 15 seconds.

30.1.2.7 External interface unit.

The M981 FIST-V manned module shall be provided with an External Interface Unit (EIU) that consists of an entry device and display device. The EIU shall be used to control and monitor the following functions:

a. Exercise number.
b. Vehicle identification number.
c. Notification of self-repairs being completed.
d. Initiation and termination of fuel transfers.
e. Initiation and termination of ammo transfers.
f. Connection and disconnection of a tow kit to another vehicle.
g. External munitions loading.

h. Damage assessment.

i. Load SINCGARS hopset and COMSEC data.

APPENDIX L
HMMWV MANNED MODULE

10. Scope.

This appendix establishes requirements for the High Mobility Multipurpose Wheeled Vehicle (HMMWV) manned module.

20. Applicable Documents.

(This section is not applicable to this appendix.)

30. Requirements.

30.1 HMMWV Simulator Module.

The HMMWV simulator shall be designed to replicate the performance characteristics of the HMMWV and associated system as described in L.30.1.1 through L.30.1.2.2. The HMMWV module shall operate in two modes the driver mode and the observer mode. The driver's position shall be the primary function when the HMMWV is in the driver mode and the observer's position shall be the primary function when the HMMWV is in the observer mode. The visual system shall function in either mode with the restrictions indicated in paragraph L.30.1.1.9. The Unit Maintenance Collection Point (UMCP) shall have the ability to tether a designated HMMWV to the Combat Service Support (CSS) supply vehicles. Then, the HMMWV provide "leader-follower" capability through the use of tethering. When the designated HMMWV is within a 200 +/- 10 meter radius of a fuel truck, ammunition truck, or maintenance truck, the HMMWV shall be able to tether to the vehicle and lead one or more of these vehicles to a desired location. The HMMWV module shall be either a M1025 or a M1043 vehicle as determined during initialization by the Master Control Console (MCC).

30.1.1 Performance Characteristics.

The following paragraphs contain the detailed performance requirements that shall be provided with the HMMWV simulator system. The HMMWV manned module shall also meet the generic design requirements of section 3.6.

30.1.1.1 Deleted.

30.1.1.2 HMMWV Weapons System.

The vehicle weapons system for the HMMWV simulation system shall have the capability for target sighting, aiming, firing and reloading of the weapons listed in paragraph L.30.1.1.3. The HMMWV shall be initialized with one or a combination of the weapons listed in paragraph L.30.1.1.3. The simulated vehicle weapons system components shall replicate the operational equipment in both design and performance. These components in combination with the other simulated systems in the HMMWV simulation system shall provide the crew the capability to engage targets from a stationary position and in the dismounted mode.

30.1.1.3 HMMWV Weapons and Ammunition.

The HMMWV simulation system shall simulate the following weapons and ammunition during vehicle stationary operations:

a. MK-19 40 mm automatic gun (M430 linked grenades),

b. M249 SAW (5.56mm ball and linked tracer A064),

c. M60 Machine Gun (7.62mm A141 Ball, Tracer)

d. .50 caliber machine gun (A534 API-T)

30.1.1.3.1 Dismount Weapons and Ammunition.

The HMMWV simulation system shall simulate the following weapons and ammunition during Dismounted Infantry (DI) operations:

a. M249 SAW (5.56mm ball and linked tracer A064),

b. M60 Machine Gun (7.62mm A141 Ball, Tracer)

30.1.1.4 Support Systems.

30.1.1.4.1 Electrical Systems.

The electrical system shall be capable of the following operation states:

a. Engine off

b. Engine running, alternator working.

c. Engine running, alternator not working

Based on which operating state the electrical system is in, the associated problems and abilities shall be reflected in the HMMWV simulation system. These problems and abilities shall be replicated in the HMMWV simulation systems just as they would occur in the operational equipment.

30.1.1.5 Depletable Resource Management.

Depletable resource management shall cover the management, consumption, and resupply of both fuel and ammunition. The HMMWV shall be resupplied from an infantry vehicle, a scout vehicle or a supply vehicle. Resupply shall be coordinated through the Administrative Logistics Center (ALOC). The fuel for the HMMWV simulation system shall be based on the fuel contained in the HMMWV's fuel tank. Resupply of fuel shall be accomplished through coordination with the ALOC. The maximum ammunition capacity for the HMMWV simulation system shall be based on the storage capabilities of the actual HMMWV for the weapons listed in paragraph L.30.1.1.3. The identification, transfer, and resupply of ammunition shall be the responsibility of the squad leader. Resupply of ammunition shall be coordinated through the ALOC. In all cases, the monitoring of, use of, and resupplying of the HMMWV's fuel and ammunition shall be based on the implementation of representative time and depletion parameters.

30.1.1.5.1 Depletable Resource Management Parameters.

These parameters shall include:

a. Transfer times.

(1) Fuel from a fuel carrier or fuel pre-stock to the HMMWV

(2) Ammunition from an ammunition truck

(3) Reload times for the weapons listed in paragraph L.30.1.1.3

(4) Ammunition transfer from a manned module with compatible ammunition

b. Depletions rates.

(1) Fuel available related to HMMWV consumption rate

(2) Ammunition basic allowance for the various weapons in paragraph L.30.1.1.3

30.1.1.6 Damage and Failure.

The list of components that shall be modeled for combat damage, stochastic failures and deterministic failure shall be as defined in Table L-I.

Table L-I. HMMWV Failures and Damage			
Component/System	**Deterministic**	**Stochastic**	**Combat Damage**
Air Filter		X	
Alternator		X	X
Antenna A and B			X
Batteries		X	X
Brake Non-hydraulic		X	
Driver			X
Drown	X		
Engine Assembly		X	X
Engine Cooling System		X	
Fuel System		X	
Glow Plug	X	X	
Hydraulic Steering		X	X
Left Roadwheel 1		X	X
Left Roadwheel 2		X	X

Table L-I. HMMWV Failures and Damage			
Component/System	**Deterministic**	**Stochastic**	**Combat Damage**
Machine Gun Inoperative		X	
Observer			X
PLGR	X		
Radio A		X	X
Radio B		X	X
Right Roadwheel 1		X	X
Right Roadwheel 2		X	X
Rollover	X		
Transfer Case		X	X
Transmission Assembly		X	X

30.1.1.7 Sound Generating System.

A sound and acoustic vibration generation system shall be provided. The sound system shall be completely separate from the communication system, and the sounds and vibrations shall be presented independently from any headphone system (i.e. multiple loudspeakers). The sounds and vibrations shall be of such fidelity, quality, realism, and volume that crew members shall experience the cues, stresses, and distractions of a "real life" combat situation. The sounds shall be of sufficient volume so that the distractions provided to the crew members shall equal that found in an actual situation, but in no case shall 81 dB be exceeded for steady state noise (measured external to the CVC helmet). Table L-II lists the sound cues that shall be provided in the M1A1 simulation system.

Table L-II. HMMWV Sound Cues
SOUND CUE
Engine cranking
Engine start to idle
Engine stop
Engine noise related to Revolutions Per Minute (RPM)
Transmission noise related to RPM
Horn
Collisions with objects (scraping and hard collisions)
.50 Caliber Machine Gun firing
MM-19 40mm automatic weapon firing
M60 Machine gun firing
M249 SAW firing
Tire noise related to wheel speed for terrain types simulated in CCTT

Table L-II. HMMWV Sound Cues
SOUND CUE
Friendly and hostile main gun fire
Friendly and hostile missile launch
Friendly and hostile rocket launch
Generic explosive sound (main gun, missile, rocket) hit
Generic explosive sound (main gun, missile, rocket) miss
Generic kinetic round hit
Friendly and hostile machine gun fire - large caliber
Friendly and hostile machine gun fire - small caliber
Friendly and hostile mine hit
Friendly and hostile bomb hit
Friendly and hostile bomb miss
Friendly and hostile artillery hit
Friendly and hostile artillery miss
Wheeled vehicle - large class
Wheeled vehicle - small class
Tracked vehicle
Aircraft - rotary wing class
Aircraft - fixed wing class

30.1.1.7.1 Sound Synchronization.

The sound system shall be synchronized with the visual displays and the HMMWV controls within the system latency requirements, as defined in paragraph 3.2.2.1 and within the module latency requirements, as defined in paragraph 3.2.2.2.

30.1.1.7.2 Sound Generator.

During real-time operation, the desired sounds shall be stored in the sound system and shall be available in real-time to the vehicle simulator module. The system shall provide outputs for driving speakers and sub-woofers. The sound generation system shall have the ability of generating a minimum of eight sounds simultaneously with full parametric control of frequency and volume. Where appropriate, sound generation channels shall be “shared” by several different sounds on a priority basis. The number of sound generation channels shall be expandable to allow for future needs that may require the capability to generate a larger number of sounds simultaneously.

30.1.1.7.3 Sound Storage.

The HMMWV simulation system shall have the capacity to store all sound data and shall be expandable to allow for future increases in storage that would be necessary to generate a larger base of sound data.

30.1.1.7.4 Spatial Positioning.

The sound system shall provide for spatial positioning of the sound cues. The sounds shall be synchronized with the actions causing the sounds and shall be presented to allow personnel the ability to identify the spatial positioning (direction, amplitude as a function of distance and time delay as a function of distance) of the events causing the sounds.

30.1.1.7.5 Audio Amplifiers.

The audio amplifiers shall be of sufficient quality and power-handling ability to recreate the required volume levels without distortion greater than 0.05 percent Total Harmonic Distortion (THD) over the dynamic range.

30.1.1.7.6 Speakers.

Audio cues shall be presented via speakers contained in the manned module crew compartment. The speaker configuration for the HMMWV manned modules shall be as defined in table L-III. Headphones shall not be required to present the ambient “sounds of battle.” Vibration cues (e.g. vehicle vibrations, weapons fire, and vibrations from explosions) shall be presented to the crew members through the use of subwoofers. Speaker placement within the modules shall support spatial positioning.

Table L-III. HMMWV Module Speaker Arrangement

MODULE TYPE	SPEAKER	SEAT SPEAKER	SUBWOOFER
HMMWV	4	2	1

30.1.1.7.7 Sound Quality.

The sound generator shall provide a frequency range of 25 Hertz (Hz) +/- 5 Hz to a minimum of 12,000 Hz. The audio amplifiers shall provide a frequency range of 25 Hz +/- 5 Hz to a minimum of 20,000 Hz. The combined signal to noise ratio of the sound generator and audio amplifiers shall be a minimum of 70 dB. The combination of speaker types shall provide a composite frequency response of 25 Hz to 20,000 Hz +/- 10 dB (after each speaker has been independently referenced to 0 dB).

30.1.1.8 Communication System.

A communication system shall be provided to the HMMWV simulation system as described in section 3.7.6 of this specification.

30.1.1.9 Visual Display System.

The visual display system shall meet the requirements stated in Appendix A, Visual System For The Close Combat Tactical Trainer. The HMMWV simulator visual system shall function in both the driving mode and the dismounted mode, as indicated in the following statements:

a. In the driver mode the HMMWV simulator shall have 108 degrees horizontal field of view and 30 degrees vertical field of view.

b. In the observer mode the HMMWV simulator shall have 108 degrees horizontal field of view and 30 degrees vertical field of view. The visual shall be able to slew 360 degrees to the right or to the left and slew in pitch 90 degrees up and 45 degrees down. The eye point shall be from either the standing, kneeling, or prone position. In the dismounted mode the observer shall have the ability to move across the terrain in any direction. The observer shall have the ability to move away from the HMMWV and turn around and see the HMMWV in the visual. The observer shall have the ability to fire the weapons listed in paragraph L.30.1.1.2.1 in the dismounted mode that were initiated. The observer position shall have a digital direction indicator available while in the dismounted mode.

30.1.2 Physical Characteristics.

The following paragraphs contain the detailed physical requirements for the individual crew positions within each HMMWV simulator module. The HMMWV crew compartment shall exist as a consolidated enclosure for the driver, and observer positions. The module enclosure base shall provide support for all module components and shall incorporate forklift provisions to facilitate handling and transportation. The HMMWV modules shall provide the controls, switches, indicators, and space constraints required to meet the training tasks while avoiding negative training. Some of these items shall be fully replicated while others shall be mock-ups to provide the tactile sensations and space constants of the actual vehicle.

30.1.2.1 Controls and Indicators.

The following paragraphs list the controls and indicators that shall be provided for the individual crew position within each HMMWV simulator. Realistic control loading and physical limits of travel shall be provided for simulated crew member controls, such as pedals, handles, and steering wheel. The functional controls, indicators, and other pieces of equipment shall have the proper coloring and labels.

30.1.2.1.1 Driver’s Position.

The following buttons, controls, gauges, lights, and switches shall be provided at the driver’s position in the locations and panels as found in the actual HMMWV.

a. The following controls, indicators and other pieces of equipment shall be simulated as follows:

(1) Panel gauges:

(a) Speedometer/Odometer - This indicator shall be a gauge with a range of 0 - 60 MPH (0 - 100 KPH) and shall indicate the vehicle speed. The Odometer shall simulate the distance the vehicle has traveled in miles.

(b) Engine Temperature gauge - This indicator shall be a gauge with a range of 120 - 240 degrees Fahrenheit and shall indicate the engine temperature of the vehicle.

(c) Vacuum gauge - This indicator shall have the following components:

i. Vacuum gauge meter - This gauge shall indicate the air flow restriction in the vehicle's engine air intake system.

ii. Reset button - This button shall reset the vacuum gauge meter.

(d) Fuel gauge - This indicator shall be a gauge with a range of E - F that shall indicate the fuel level in the vehicle's fuel tank.

(e) Oil Pressure gauge - This indicator shall be a gauge with a range of 0 - 120 that shall indicated the oil pressure of the vehicle.

(f) Electrical System Indicator - This indicator shall be a gauge that indicates the condition of the vehicle's electrical system.

(2) Parking Brake Lever - This lever shall utilize a functional assembly used to engage and disengage the parking brake for the vehicle. The force required for activation shall be 5.0 lbs +/- 2.0 lbs breakaway and 35.0 lbs +/- 5.0 lbs ending. The release force shall be 12.0 lbs +/- 3.0 lbs.

(3) Parking Brake Light - This indicator shall illuminate when the parking brake has been applied. It shall be a red lamp.

(4) Steering Control - The steering control shall utilize a control assembly with 5.0 lbs +/- 1.0 lb. steering force. Deflection of the control from center position shall command the vehicle to turn. This assembly shall also simulate the actual force necessary to turn the wheel as in the real vehicle.

(5) Transmission Shift Lever - This lever shall have five positions simulating the movement of the transmission range selector for the actual vehicle. The lever shall simulate the reverse, neutral, drive, second and first positions including a push button on the end of the handle which will engage/disengage the locking feature of the handle. The handle's position shall be monitored by discrete inputs.

(6) Transfer Case Shift Lever - This lever shall have four positions simulating the movement of the transfer case shift lever. This lever shall be used to select the following driving ranges:

H - High range,

H/L - High Locked range,
L - Low range,
N - Neutral.

(7) Accelerator Pedal - This pedal shall incorporate a control assembly providing 2.5 pounds +/- 1.0 pounds breakaway and 35.0 pounds +/- 5.0 pounds ending force.

(8) Brake Pedal - This pedal shall be a functional assembly used to activate the braking action of the vehicle. A 5.0 lb +/- 2.0 lb. breakaway and 35.0 lb +/- 5.0 lb. ending force shall be provided.

(9) Engine Function Switch - This three position switch shall provide the following engine control functions: These positions shall provide the computer system with one digital input for each position to allow the system to determine which function is being selected.

(a) “ENG STOP” - Shall stop the engine.

(b) “RUN” - Shall simulate the activation of the engine’s glow plugs.

(c) “START” - Shall simulate the engine’s starter and starting sequences.

(10) Wait-to-Start Lamp - shall be an amber lamp that illuminates when the glow plugs are activated and is extinguished when the vehicle’s engine is ready to be started.

(11) Manual Throttle Control - This handle shall utilize a control assembly that shall change the speed of the engine when forces are applied to the handle.

(12) Night Vision Capability (Driver) - Night vision shall be implemented utilizing the existing visual displays. A trainer unique momentary pushbutton switch shall be provided to the driver which will enable and disable the night vision capability for the driver.

(13) Driver’s Seat - Shall be functionally replicated. The seat shall have a full range of motion and adjustments as on the actual vehicle.

(14) Driver’s Seat belt - The driver’s seat shall be provided a mechanically operable seat belt

(15) Inside Light - The driver’s position shall include a lamp in which the inside of the vehicle module can be illuminated.

(16) Driver/Observer - This switch shall be used to switch the trainer between driver's mode and observers mode. Each mode shall only be activated when the vehicle/observer is in the proper configuration.

(17) Deleted

(18) Windshield Wiper Control - This device shall be a three position rotary knob for HIGH, LOW and OFF operations of the windshield wipers. The windshield wiper control shall be physically replicated, but non-functional.

(19) Driver's Condition indicator - shall be a trainer unique 2 lamp assembly. An amber lamp shall be illuminated when the driver is considered to be wounded; a red lamp shall be illuminated when the driver is considered dead. Indicators shall be located in a position where both the observer and driver can observe the indicators.

(20) Light switch assembly shall be simulated and fully functional.

(a) Panel light switch shall be a four position rotary switch which shall control the panel lights as follows:

PANEL BRT position: Panel lights are brightly lit
OFF position: Panel lights are off.
DIM position: Panel lights are dimly lit.
PARK position: Stop lights and tail lights are lit.

(b) Lights UNLOCK switch shall be a spring-loaded, two-position lever. When held in the UNLOCK position, this lever will allow Driving Lights switch to be moved from BO MARKER to BO DRIVE, from OFF to STOP LIGHTS, and from STOP LIGHTS to SERVICE DRIVE. The lever shall return to the locked position when released.

(c) Driving lights/main lights switch shall be a five position rotary switch which shall control exterior lights as follows:

B.O. DRIVE position: Enables the I.R. - B.O. SELECT switch to choose either infrared or blackout mode for night driving

B.O. MARKER position: Blackout marker lights are lit. Blackout stoplight lights when brakes are applied

OFF position: All exterior lights are off

STOPLIGHT position: Stoplight lights when brakes are applied

SERvice DRIVE position: Service headlights and taillights are lit. Stoplight lights when brakes are applied.

(21) Horn Button - shall be physically and functionally replicated. Horn sound shall only be audible within the HMMWV module.

b. The following controls, indicators and other pieces of equipment shall be physically represented (operational but non-functional):

(1) Foot activated dimmer switch,

(2) Deleted.

(3) Turn Signal lever.

30.1.2.1.2 Observer Position.

The observer position shall have the following controls, switches, gauges, buttons and lights:

30.1.2.1.2.1 Dismounted Mode.

The observer position shall have the following controls, functional during the dismounted mode:

a. There shall be a control device for movement across the terrain and slewing the visual display.

b. There shall be a control device for selecting the eye points specified in L.30.1.1.9.b.

c. There shall be a digital direction indicator.

d. There shall be a control device to employ the weapons listed in paragraph L.30.1.1.3 (means for sighting the weapons in the visual display).

e. Shall have a seven power binocular and night vision capability. The seven power binocular viewing and night vision capability shall be active only in the dismounted mode.

f. A Plan View Display (PVD) shall be provided.

30.1.2.1.2.2 Mounted/Dismounted Controls.

The observer position shall have the following controls, functional during the mounted and dismounted mode:

30.1.2.1.2.2.1 SINCGARS Radio.

SINCGARS Radio - The SINCGARS (RT-1523A) shall be compatible with organizational requirements except as indicated in 3.7.6 for vehicle and headquarters radio configurations and shall allow for communication with the Operations Center (OC) and other desired units.

30.1.2.1.2.2.1.1 Radio Controls.

It shall simulate the following controls:

a. ANT connector shall be a dummy 3-D connector which shall have a dummy cable. The long range (lower) radio shall connect to the RF power amplifier. The short range (upper) radio shall connect to the chassis (representing connecting to the vehicle antenna).

b. CHAN (channel) switch shall select manual, preset and cue frequencies. This switch shall be an 8 - position rotary switch with pointer knob which utilizes the following positions:

(1) CUE - This position shall allow the operator to preset SC frequency for the CUE channel or select the preset CUE frequency.

(2) MAN - This position shall allow the operator to preset SC frequency for the MAN channel or select the preset MAN frequency.

(3) 1 - This position shall allow the operator to preset a SC frequency for channel 1. This position shall also select the preset SC frequency when in SC mode and the FH hopset when in FH mode for channel 1. The loading of preset FH channels or COMSEC keys shall be simulated using the external interface unit.

(4) 2 - This position shall allow the operator to preset a SC frequency for channel 2. This position shall also select the preset SC frequency when in SC mode and the FH hopset when in FH mode for channel 2. The loading of preset FH channels or COMSEC keys shall be simulated using the external interface unit.

(5) 3 - This position shall allow the operator to preset a SC frequency for channel 3. This position shall also select the preset SC frequency when in SC mode and the FH hopset when in FH mode for channel 3. The loading of preset FH channels or COMSEC keys shall be simulated using the external interface unit.

(6) 4 - This position shall allow the operator to preset a SC frequency for channel 4. This position shall also select the preset SC frequency when in SC mode and the FH hopset when in FH mode for channel 4. The loading of preset FH channels or COMSEC keys shall be simulated using the external interface unit.

(7) 5 - This position shall allow the operator to preset a SC frequency for channel 5. This position shall also select the preset SC frequency when in SC mode and the FH hopset when in FH mode for channel 5. The loading

of preset FH channels or COMSEC keys shall be simulated using the external interface unit.

(8) 6 - This position shall allow the operator to preset a SC frequency for channel 6. This position shall also select the preset SC frequency when in SC mode and the FH hopset when in FH mode for channel 6. The loading of preset FH channels or COMSEC keys shall be simulated using the external interface unit.

c. RF PWR switch shall be a 4 position rotary switch with pointer knob, with the following positions:

(1) LO - This position shall set the operation of transmission power to low.

(2) M - This position shall set the operation of transmission power to medium.

(3) HI - This position shall set the operation of transmission power to high.

(4) PA - This position shall set the operation of transmissions for use with the power amplifier, or high power if power amplifier is not connected to the RT.

d. MODE Switch - This switch shall be a 3 - position rotary switch with pointer knob, with the following positions:

(1) SC - This position shall set the Receiver/Transmitter to SC (single channel) mode.

(2) FH - This position shall set the Receiver/Transmitter to FH (frequency hopping) mode.

(3) FH-M - This position shall set the Receiver/Transmitter to FH-M (frequency hopping master) mode. The operator shall be required to pull the switch to go into the FH-M position.

e. RXMT connector shall be a dummy 3-D connector.

f. FCTN(function) Switch - This switch shall be a 9 - position rotary switch with pointer knob, with the following positions:

(1) STBY - This position shall turn off receiver/transmitter (RT) while maintaining memory. The operator shall be required to pull the switch knob in order to go to the STBY position.

(2) TST - This position shall cause the normal self test indicators to be displayed on the keyboard display.

(3) LD - This position shall load SC frequencies, and shall also allow the operator to receive ERF data from a RT operating in FH-M mode.

(4) SQ ON - This position shall turn on the RT and activate the squelch.

(5) SQ OFF - This position shall turn on the RT and deactivate the squelch.

(6) RXMT - This position shall be nonfunctional. The retransmit mode of the RT shall not be simulated.

(7) REM - This position shall disable the RT's front panel controls.

(8) Z-FH - This position shall clear the RT of all FH data. The operator shall be required to pull the switch knob in order to go to the Z-FH position.

(9) OFF - This position shall turn off all power to the RT. This function shall also erase the RT's memory. The operator shall be required to pull the switch knob in order to go to the OFF position.

g. DIM Control - This shall be a active control which replicates the appearance and function of the corresponding actual knob.

h. Keyboard Display shall display all information concerning the operation of the RT including SC frequencies, FH data, error messages, data rates as well as keyboard entries. The display shall consist of 8 full 5 X 7 dot matrix characters that are alphanumeric with the capability to display special characters. The seventh 5 X 7 dot matrix character shall be capable of displaying no dots on column number one, on column number two only displaying dots on rows one, three, five, and seven that have the capability to be lighted individually, no dots on column number three, and capable of lighting all the dots on columns four and five at the same time. The eighth dot matrix character shall also be capable of displaying dots arranged in the form of a diamond. All displays shall be dimmable. Color of display shall be green.

i. Keypad shall be responsible for the entering data into the RT. The keypad shall consist of the following 16 pushbutton keys:

(1) CMSC 1 - Shall display the COMSEC key identifier number on the display and enter the number '1' into the system.

(2) * 2 - Shall enter the number '2' into the system. The special feature activated by this key on the actual RT shall not be selectable or simulated.

(3) SYNC 3 - Shall place the RT into 'late entry' status allowing the RT to re-enter the network. Also shall enter the number '3' into the system.

(4) FREQ - Shall allow the operator to load and clear SC frequencies in the RT.

(5) DATA 4 - Shall display the RT's operational data rate and enter the number '4' into the system.

(6) 5 - Shall enter the number '5' into the system.

(7) 6 - Shall enter the number '6' into the system.

(8) ERF OFST - Shall transmit ERF data to net members when RT is operating in FH-M mode. Also shall load/check SC offset frequencies.

(9) CHG 7 - Shall change current information on display to another available selection. Shall also enter the number '7' into the system.

(10) 8 - Shall enter the number '8' into the system.

(11) LOUT 9 - Shall enter the number '9' into the system. Shall also retrieve the frequency lockout sets from permanent memory if the RT is operating as Frequency Hop Master.

(12) TIME - Shall be used to check RT FH sync time clock.

(13) CLR - Shall clear data from display if error was made during entry. Shall also be used to clear data from RT memory.

(14) LOAD 0 - Shall load data into holding memory in RT and to retrieve data from permanent memory into holding memory. Shall also be used to enter the number '0' into the system.

(15) STO - Shall transfer data from RT holding memory onto permanent memory.

(16) BATT CALL - Shall be non-functional.

j. COMSEC switch shall be responsible for controlling the communication security modes of the RT. It shall be a 5 - position rotary switch with pointer knob, with the following positions:

(1) PT - This position shall place the RT into plain text mode. The operator shall be required to pull the knob in order to place the knob into this position.

(2) CT - This position shall place the RT into cipher text mode.

(3) TD - This position shall be non-functional.

(4) RV - This position shall prepare the RT to receive a remote fill of COMSEC variables from the NCS.

(5) Z - This position shall clear COMSEC keys. The operator shall be required to pull the knob in order to place the knob into this position.

k. VOL WHSP control shall be a rotational knob used for audio volume control. The knob shall also provide a pullout position which shall be non-functional.

l. HUB Connector - Dummy cover that shall not be removable.

m. AUD/FILL connector shall be a dummy 3-D connector.

n. AUD/DATA shall be a dummy 3-D connector. A dummy cable shall connect to the AUD/DATA connector and the DATA A or DATA B connector of the mounting adapter.

30.1.2.1.2.2.1.2 Radio Mounting.

Radio Mounting - the SINCGARS shall be mounted in a short/long range radio configuration. This mounting shall replicate the AN/VRC-89A configuration which contains the following components:

(1) Amplifier-Adapter, Vehicular (mounting adapter) AM-7239B/VRC.

(2) Amplifier, Radio Frequency AM-7238A/VRC.

(3) Receiver-Transmitter, Radio RT-1523 A.

(4) Receiver-Transmitter, Radio RT-1523 A.

(5) Loudspeaker Control Unit, LS-671/U, and a handset, and a handset mounting bracket.

(5) Loudspeaker Control Unit, LS-671/U, and a handset, and a handset mounting bracket.

30.1.2.1.2.2.1.2.1 Mounting Adapter.

The mounting adapter shall have two SINCGARS receiver-transmitters as described in 30.1.2.1.2.g.1. The mounting adapter shall have a simulated Radio Frequency Amplifier connected, and shall also have the following components:

a. CB1 (power) switch shall be a two position trippable toggle switch with an ON and OFF position.

b. Indicator lamp and lens shall be a green dimmable indicator. The indicator shall flash for 3 +/- 1 seconds after the CB1 switch is moved to the ON position, then stays lit. The lens shall allow the indicator to be dimmed by turning clockwise.

c. The (AUD/DATA B J2) connector shall be a 3-D dummy connector.

d. The (AUD/DATA A J3) connector shall be a 3-D dummy connector.

e. The (DATA B J4) connector shall be a 3-D dummy connector with a dummy cable connected to the AUD/DATA connector on the top radio.

f. The (DATA A J5) connector shall be a 3-D dummy connector with a dummy cable connected to the AUD/DATA connector on the bottom radio.

g. The (SPKR J6) connector shall be a 3-D dummy connector.

30.1.2.1.2.2.1.2.2 Radio Frequency Amplifier.

The Radio Frequency Amplifier shall be connected to the mounting adapter. The Radio Frequency Amplifier shall have the following components:

a. The (J1) connector shall be a dummy connector. A dummy cable which represents the connection to a vehicle antenna shall be connected to the J1 connector.
b. The (J2) connector shall be a dummy connector. A dummy cable which also connects to the ANT connector of the RT mounted in the bottom position of the mounting adapter shall be connected to the J2 connector.

30.1.2.1.2.2.2 Observer’s Seat.

Observer’s Seat - Shall be functionally replicated. The seat shall have the full range of motion and adjustments as on the actual vehicle. A mechanically operable lap seat belt shall be provided.

30.1.2.1.2.2.3 Observer’s Condition Indicator.

Observers Condition Indicator - shall be a trainer unique 2 lamp assembly. An amber lamp shall be illuminated when the observer is considered to be wounded; a red lamp shall be illuminated when the observer is considered dead. Indicators shall be located in a position where both the observer and driver can observe the indicators.

30.1.2.1.3 Trainer Unique.

Simulated compass (grid azimuth indicator) - shall be a three digit display depicting the orientation of the long axis of the vehicle on the simulated terrain referenced to grid north. The simulated compass shall be available inside the compartment only after the vehicle has been stationary for 15 seconds.

30.1.2.1.4

Precision Lightweight GPS Receiver (PLGR+96 SPS) shall be physically installed as in the operational unit, except where simulated vehicle space constraints apply and functionally replicated as described in paragraph 3.7.6.4.

30.1.2.2 External Interface Unit.

The HMMWV manned module shall be provided with an External Interface Unit (EIU) that consists of an entry device and display device. The EIU entry device shall be used to control and monitor the following functions:

a. Exercise number.

b. Vehicle identification number.

c. Notification of self-repair being completed.

d. Initiation and termination of fuel transfers,

e. Initiation and termination of ammo transfers,

f. Connection and disconnection of a tow kit to another vehicle.

g. External munitions loading.

h. Damage assessment.

i. Load SINCGARS hopset and COMSEC data.